Response Action Contract
for Remedial, Enforcement Oversight, and Non-Time
Critical Removal Activities at Sites of Release or
Threatened Release of Hazardous Substances
in EPA Region VIII

U.S. EPA Contract No. 68-W5-0022

Final Sampling and Analysis Plan
Remedial Investigation
Libby Asbestos Site, Operable Unit 4

May 19, 2003

Work Assignment No.: 137-RIRI-08BC
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Acronyms

AHERA	Asbestos Hazard Emergency Response Act
AIFF	additional information field form
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
BD	building location identification number
CAG	community advisory group
CAR	corrective action request
CDM	CDM Federal Programs Corporation
CIC	community involvement coordinator
COC	chain-of-custody
cm^2	centimeter squared
CSS	contaminant screening study
DI	deionized water
DQOs	data quality objectives
eCOC	electronic chain-of-custody
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FAQ	frequently asked questions
FSDS	field sample data sheet
FSP	field sampling plan
GIS	geographic information system
GLP	good laboratory practices
GPS	global positioning system
HASP	health and safety plan
HSO	health and safety officer
IDW	investigation-derived waste
IFF	information field form
in.	inches
LA	Libby amphibole
MCE	mixed cellulose ester
MDEQ	Montana Department of Environmental Quality
mm	millimeter
NIOSH	National Institute of Occupational Safety and Health
NIST	National Institute of Standards and Technology
NVLAP	National Voluntary Laboratory Accreditation Program
OU	operable unit
PLM	polarized light microscopy
PPE	personal protective equipment
QA	quality assurance
QAC	quality assurance coordinator
QAM	quality assurance manager
QAPP	quality assurance project plan
QC	quality control
QMP	quality management plan

QP	quality procedure
RAC	Response Action Contract
RI	remedial investigation
RPM	remedial project manager
S/cm^2	structures per centimeter squared
SAP	sampling and analysis plan
SOP	standard operating procedure
SP	sample point location identification number
TEM	transmission electron microscopy
USGS	U.S. Geological Survey
VCBM	vermiculite containing building material
VCI	vermiculite containing insulation
Volpe Center	John A. Volpe National Transportation Systems Center

Section 1
Introduction

This document serves as the sampling and analysis plan (SAP) for the remedial investigation (RI) activities for the Libby Asbestos Site Operable Unit (OU) 4 under the Response Action Contract (RAC). This SAP outlines the support that CDM Federal Programs Corporation (CDM) will provide to the U.S. Environmental Protection Agency (EPA) under Work Assignment 137-RIRI-08BC.

This section provides an explanation of purpose of the RI sampling, background information related to the initiation of the RI, and project organization. An expanded site background is provided in Section 2 of the Contaminant Screening Study (CSS) SAP Revision 1 (CDM 2003c).

1.1 Background

Historical investigations at the Libby Asbestos Site include the Phase I and Phase II sampling programs. The Phase I sampling program, initiated in early 2000, was designed as a rapid pilot-scale investigation to:

- Determine whether or not airborne asbestos levels in Libby required time-critical action to protect public health
- Quantify asbestos levels in potential source materials
- Identify appropriate analytical methods to screen for and quantify asbestos

The Phase II sampling program began in March 2001 and was designed to provide human exposure and health risk estimates through collection of systematic data on asbestos levels in air and other media and identification of sources of airborne asbestos.

Through the Phase I and II programs EPA determined:

- Exposure to Libby amphibole (LA) is a threat to human health (EPA 2001a).
- Release of respirable LA occurs when source materials are disturbed (EPA 2001a).
- Source materials include vermiculite containing insulation (VCI), vermiculite products and process wastes, and soil containing greater than 1 percent LA.
- Household dust is a potential exposure pathway.
- Time critical removals are necessary and, therefore, were initiated.
- There is widespread presence of LA throughout the study area.
- All properties in the study area should be evaluated for the presence of LA.

Phase I and II investigations identified the need to evaluate all properties in the Libby study area for the presence of potential sources of LA. The CSS was designed as an interim step in the RI to meet this need.

The CSS was initiated in May 2002 with the goal to categorize every property as remediation required, no remediation required, or additional information required to determine remediation requirements in accordance with EPA's May 2002 action memorandum amendment (EPA 2002).

The CSS investigation used a combination of visual inspections, verbal interviews, and soil sampling to screen each property in the study area for the presence or absence of potential sources of LA. Screening and sampling efforts focused on areas of the property where vermiculite products were most likely to be encountered (e.g., attic insulation and garden soil) and where the potential disturbance and exposure to LA-containing vermiculite was most likely (e.g., near-surface soils).

During the 2002 CSS, 3,534 properties were visited. Based on the Remedial Action Work Plan (RAWP) (CDM 2003e) and the CSS interim results report (CDM 2003a) (Appendix A), 1,340 properties were identified as remediation required (i.e., exhibited at least one remedial trigger) in an indoor or outdoor location of concern. Another 708 properties were categorized as additional information required (i.e., inconclusive presence of remedial triggers). Lastly, 1,104 met the no remediation required criteria (i.e., no remediation triggers were observed or detected). All property categorization is contingent upon soil sample results. Once results are received properties maybe re-categorized. The remaining 454 properties visited during 2002 were either vacant, the owner refused to participate in the investigation, or the sampling teams were unable to make contact with the property owner following multiple visits.

The information collected during the 2002 CSS activities was used to group properties into one of nine planning categories:

Remediation Required (1,340 properties)
1. Indoor remediation required (242 properties)
2. Outdoor remediation required (742 properties)
3. Indoor and outdoor remediation required (222 properties)
4. Indoor remediation and outdoor sampling required (40 properties)
5. Outdoor remediation and indoor sampling required (94 properties)

Additional Information Required (709 properties)
6. Indoor sampling required (569 properties)
7. Outdoor sampling required (83 properties)
8. Indoor and outdoor sampling required (57 properties)

No Remediation Required (1,103 properties)
9. No remediation required (1,103 properties)

Properties in categories 1, 2, and 3 have remediation triggers summarized in Table 1-1. Pre-design inspection teams will collect additional sampling required to determine

specific remediation needs at properties in categories 4 and 5. The sampling activities detailed in this SAP will focus on collection of information from categories 6, 7, and 8. The information collected at these properties will be used to determine remediation requirements. The process used to place properties into the nine planning categories and the interim results of the CSS are detailed in the CSS interim results report (CDM 2003a) (Appendix A).

1.2 Objectives

Based on the information collected during the 2002 CSS activities, the 2003 RI program is designed to meet two main objectives:

1. To complete the CSS investigation in the Libby study area as detailed in the CSS SAP Revision 1 (CDM 2003c) concurrently with the RI properties where CSS activities are conducted during 2003.

2. To collect information at properties in the indoor sampling, outdoor sampling, and indoor and outdoor sampling categories. This information will be used to determine if remediation is or is not required at these properties. No remediation triggers (Table 1-1) have been identified at properties in these categories.

Table 1-1 Remedial Trigger Criteria

Location	Remedial Trigger Criteria
Indoor	
Attic	■ Presence of VCI in attic ■ Indication of VCI removed or dust sample in attic with concentration greater than or equal to 5,000 structures per square centimeter (S/cm^2)
Living Space	■ Presence of VCI in living space ■ Dust samples with concentration greater than or equal to 5,000 S/cm^2
Outdoor	
Specific Use Areas	■ Visible vermiculite
Other Soil Areas	■ Soil sample with concentration greater than or equal to 1 percent LA

Specific use areas: gardens, former gardens, flowerbeds, former flowerbeds, and stockpiles

1.3 Report Organization

This SAP is comprised of a field sampling plan (FSP) and a quality assurance project plan (QAPP) specific to this RI sampling in OU 4. The purpose of this SAP is to provide guidance to ensure that all environmentally related data collection procedures and measurements are scientifically sound and of known, acceptable, and documented quality and that they are conducted in accordance with the requirements of the project. The following sections and appendices are included in this SAP:

Section 1	Introduction
Section 2	Project Organization
Section 3	Data Quality Objectives (DQOs)

Section 4	Field Program Rationale, Methods, and Procedures
Section 5	Laboratory Analysis and Requirements
Section 6	Quality Assurance (QA)/Quality Control (QC) Program
Section 8	References
Appendix A	CSS Interim Results Report
Appendix B	Health and Safety Plan (HASP)
Appendix C	CDM Technical Standard Operating Procedures (SOPs) and Site-Specific Guidance Documents
Appendix D	Libby Asbestos Project Record of Deviation/Request for Modification Form
Appendix E	American Society for Testing and Materials (ASTM) Method D5755-95
Appendix F	Quality Assurance Manager (QAM) Checklist

1.4 Project Schedule and Deliverables

Fieldwork to initiate the RI is expected to begin on or about May 19, 2003 and continue until October 2003. See the project work plan (CDM 2003b) for the schedule of additional deliverables. Resulting project deliverables will include a section regarding adherence to this SAP, any deviations that occurred, and any resulting corrective action taken.

Section 2
Project Organization

RI responsibilities for EPA and CDM's RI project team are described in this section. The project organization chart is presented in Figure 2-1.

2.1 EPA Management

The EPA remedial project manager (RPM), Mr. Jim Christiansen, is CDM's primary contact for coordinating RI work at the Libby Asbestos Site. Mr. Christiansen, as RPM, is responsible for the management and coordination of the following activities:

- Defining the scope of the RI
- Defining data quality objectives
- Reviewing all project deliverables
- Maintaining communications with the CDM RI project manager for updates on the status of the RI activities

2.2 CDM Management

The CDM management team will be comprised of the following positions: Libby project manager (PM), RI PM, onsite manager, field team leader, data validation coordinator, quality assurance manager (QAM), field health and safety officer, and QA coordinator (QAC).

2.2.1 CDM Project Manager

The CDM PM for overall work at the Libby Asbestos Site is Tim Wall. Mr. Wall, as PM, is responsible for the overall management and coordination of the following activities:

- Maintaining communication with Volpe regarding the overall status of the Libby Asbestos Project
- Preparing status reports for Volpe
- Supervising production and review of deliverables for Volpe
- Tracking overall budgets and schedules
- If applicable, notifying the responsible QA staff immediately of significant problems affecting the quality of data or the ability to meet project objectives
- Procuring laboratory subcontracts

2.2.2 RI Project Manager

The RI PM is Jeff Montera. Mr. Montera is EPA's primary contact for coordinating RI work at the Libby Asbestos Site. Mr. Montera, as the RI PM, is responsible for the management and coordination of the following activities:

- Maintaining communication with EPA regarding the status of the RI
- Tracking budgets and preparing status reports for EPA
- Supervising production and review of deliverables for EPA
- Maintaining communication with CDM's Libby project manager Tim Wall
- If applicable, notifying the responsible QA staff immediately of significant problems affecting the quality of data or the ability to meet project objectives
- Incorporating and informing EPA and Volpe of changes in the work plan, SAP, HASP, QAPP, and/or other project documents associated with the RI

2.2.3 Onsite Manager

The CDM onsite manger is David Schroeder. Mr. Schroeder, as the onsite manager, is responsible for the management and coordination of the following activities:

- Maintaining communication with Mr. Wall, Mr. Montera, and the onsite representative from Volpe concerning the daily activities of the RI
- Coordinating daily work activities
- Scheduling personnel and material resources needed to complete the RI
- If necessary, identifying problems and resolving difficulties in consultation with EPA, Volpe, and CDM staff
- Ensuring field aspects of the investigation, including this QAPP, SAP, and other project documents, are implemented by the RI task leader
- Organizing and conducting daily meetings with onsite personnel
- Implementing and documenting corrective action procedures at the team level
- Providing communication between the sampling team and project management

2.2.4 Field Team Leader

The CDM field team leader is Ms. Dee Warren. Ms. Warren, as the field team leader, is responsible for the management and coordination of the following activities:

- Ensuring that all sample team members are trained in proper sample collection and field documentation as described in this SAP
- Ensuring that sampling is conducted in accordance with pertinent CDM SOPs and that the quantity and location of the samples meet the requirements of this SAP
- Maintaining proper supplies necessary for each sampling team
- Performing QC checks of field team documentation and a 2 percent check of field observations and completing required documentation of the QC checks
- Coordinating with the onsite manager regarding the daily activities of the RI
- Implementing field aspects of the investigation, including this QAPP, SAP, and other project documents

2.2.5 CDM Health and Safety Coordinator

The CDM health and safety coordinator for the Libby Asbestos Site is responsible for the following:

- Ensuring all work will be conducted in accordance with the site-specific HASP that governs the fieldwork outlined in this SAP
- Updating the HASP and ensuring the field health and safety officer is informed of the changes

The CDM field health and safety officer for the Libby Asbestos Site is responsible for the following:

- Ensuring that the protocols specified in the HASP are carried out during field activities
- Ensuring that copies of the HASP and CDM health and safety manual are maintained at the site at all times
- Based on existing site conditions, upgrading or downgrading levels of protection in accordance with the HASP
- Conducting an initial health and safety meeting for all personnel
- Providing an overview of the HASP to all assigned field personnel and having them sign a form to indicate they understand the content of the HASP document and will adhere to its specifications
- Contacting the health and safety coordinator if any questions or issues arise during field activities

2.2.6 Quality Assessment Coordinator

The CDM quality assessment coordinator is Ms. Cherrie Zakowski. Ms. Zakowski, as the quality assessment coordinator, is responsible for the management and coordination of the following activities:

- Ensuring that data is being validated in a timely manner in accordance with guiding documents
- Receiving and maintaining data (electronic and hardcopy) from project laboratories
- Coordinating with Volpe database personnel with regards to uploading data validation information into the project database

2.2.7 Quality Assurance Coordinator

The CDM QAC is Ms. Krista Lippoldt. Ms. Lippoldt, as the QAC, is responsible for the management and coordination of the following activities:

- Directing the overall project QA program
- Reviewing and approving the project-specific documents
- Maintaining awareness of active projects and their QA/QC needs
- Consulting with the CDM QA manager, as needed, on appropriate QA/QC measures and corrective actions
- Conducting field and office audits to check on the use of appropriate QA/QC measures, if applicable
- Providing monthly written reports on QA/QC activity to the CDM QA director

The QAC reports to CDM's QA director, Mr. George DeLullo. The QA director is independent of the technical staff and reports directly to the president of CDM on QA matters. The QA director, thus, has the authority to objectively review projects and identify problems and the authority to use corporate resources as necessary to resolve any quality-related problems.

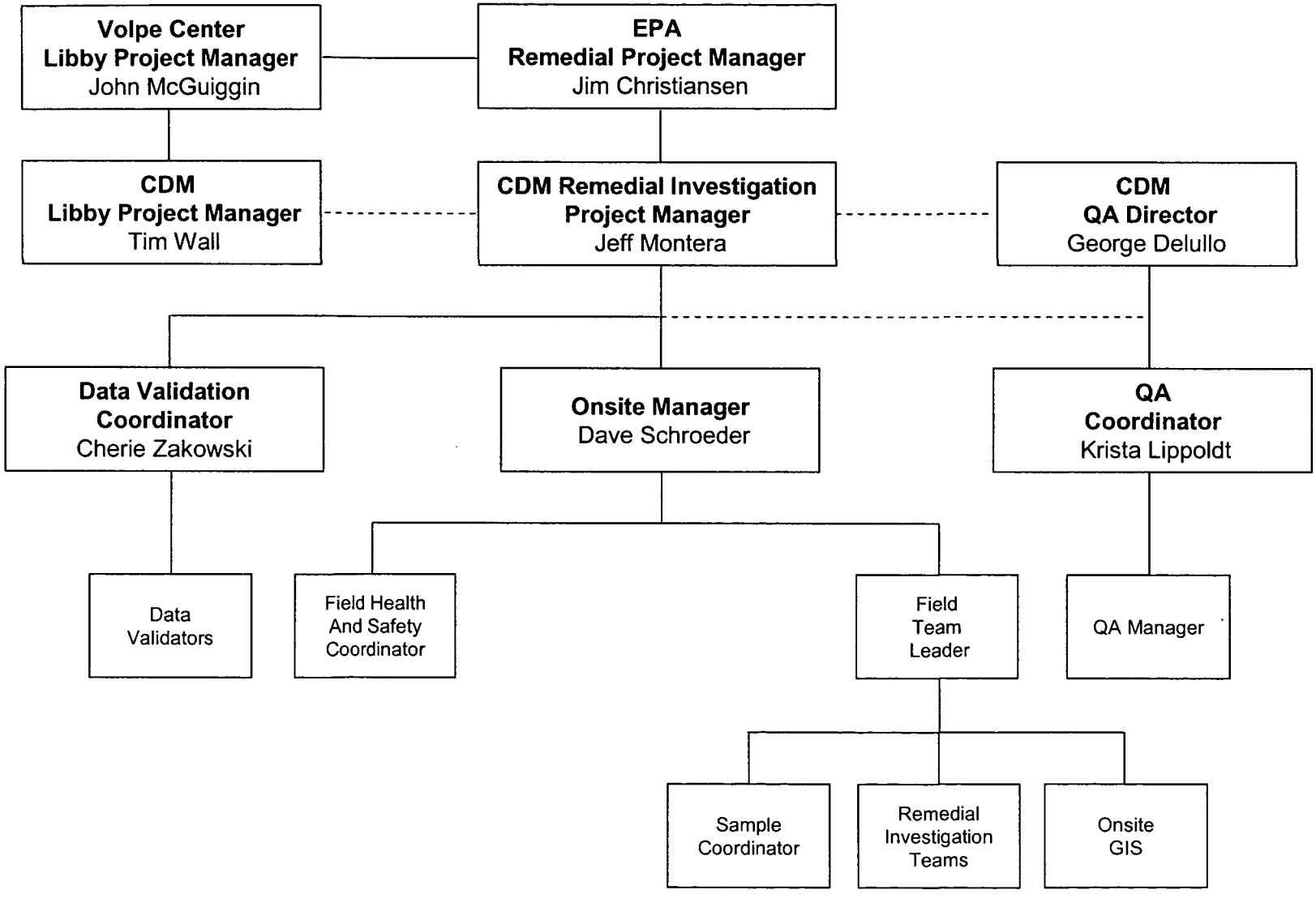
2.2.8 Quality Assurance Manager

The CDM QAM for the Libby Asbestos Site is responsible for the following:

- Monitoring all quality assurance/quality control (QA/QC) activities of the project (as described in Section 6)
- Identifying QA areas that need changes or improvements

- Verifying that corrective actions resulting from staff observations, QA/QC surveillances, and/or QA audits are documented and implemented
- Communicating directly with the CDM project manager and onite manager regarding daily QA/QC issues

Figure 2-1: Remedial Investigation Project Management Organization Chart



Color Map(s)

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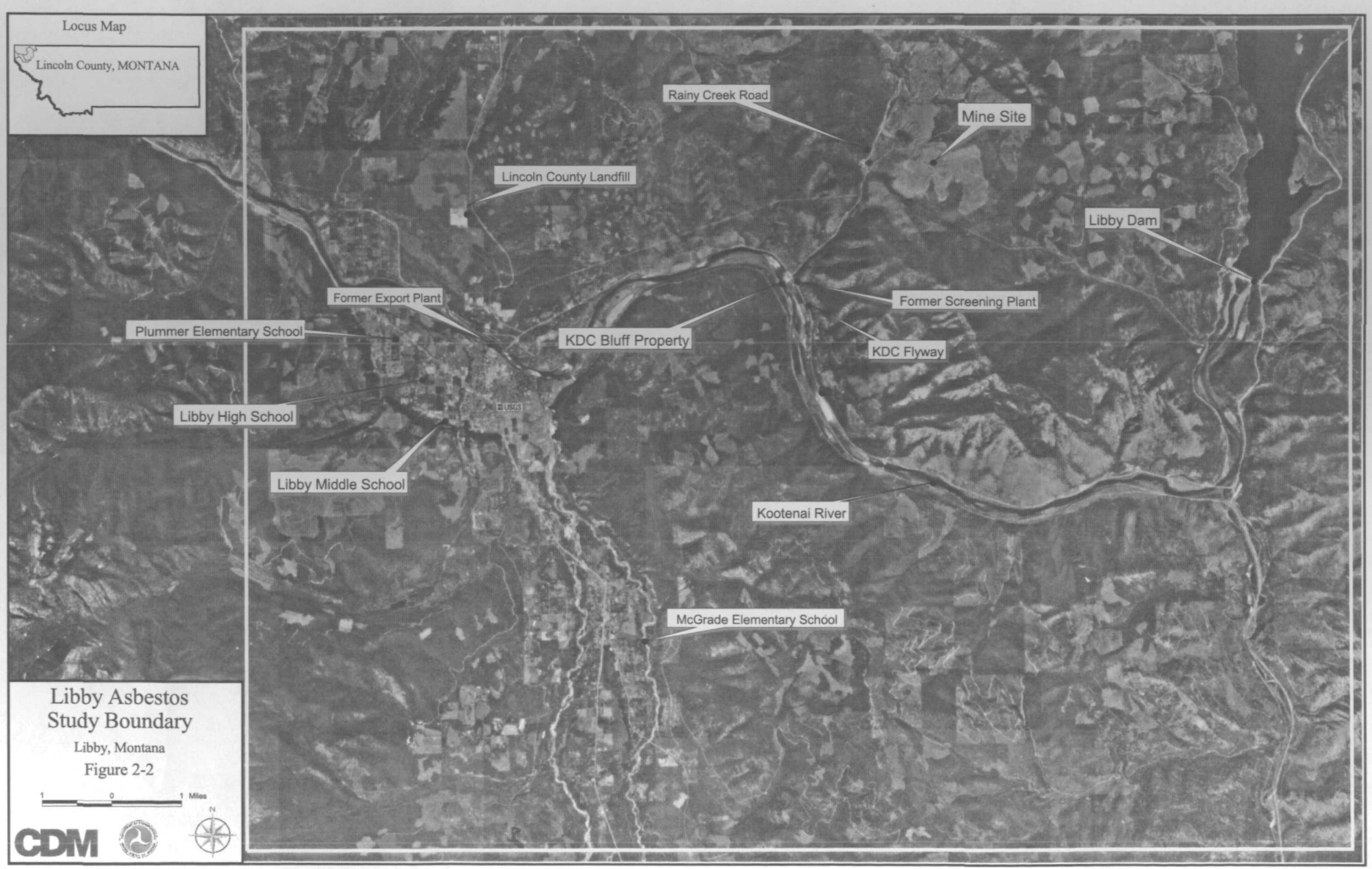
To view the actual images, please contact the Superfund Records Center at (303) 312-6473.


Locus Map
Lincoln County, MONTANA
Rainy Creek Road
Mine Site
Lincoln County Landfill
Libby Dam
Former Export Plant
Former Screening Plant
Plummer Elementary School
KDC Bluff Property
KDC Flyway
Libby High School
Libby Middle School
Kootenai River
McGrade Elementary School
Libby Asbestos
Study Boundary
Libby, Montana
Figure 2-2
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Section 3
Data Quality Objectives

The DQO process is a series of seven planning steps based on the scientific method that are designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended purpose. The goal of the DQO process is to help assure that data of sufficient quality are obtained to support remedial response decisions, reduce overall costs of data sampling and analysis activities, and accelerate project planning and implementation. The DQO process related to this CSS is presented below and includes all information as required under the seven-step process.

Site background leading to the CSS is documented in the CSS SAP Revision 1 (CDM 2003c).

Because LA-containing vermiculite products have been used randomly at unknown properties in the past, EPA has determined that each property in the study area requires screening for potential sources of LA. A sampling program, which exhaustively measures all potential LA sources and exposures at each property in one step (e.g. extensive indoor dust sampling, transmission electron microscopy [TEM] analysis, and risk-based outdoor sampling), is both unnecessary and cost/time prohibitive. A two-step sampling program, which builds upon past EPA investigations in Libby in order to limit future analytical costs while still making sound decisions, is a more efficient approach. In this regard, the CSS was designed as the first phase of these two steps. The primary objective of the CSS was to determine the presence or absence of potential LA sources at each property in the study area.

The CSS was intended to screen all properties in the study area and generally classify them as either:

1. LA is present and it is likely that no further investigation will be necessary to determine that property requires cleanup (remediation required).

2. LA is or may be present, but additional sampling and investigation is required to determine if cleanup is warranted. The 2nd phase of the RI (the procedures detailed in this SAP) will address these properties (additional information required).

3. There is no evidence that LA is present and it is likely that no cleanup or further investigation will be required (no remediation required).

During the 2002 CSS, 3,534 properties were visited and placed into one of nine property categories based on the criteria presented in the CSS interim results report (CDM 2003a) (Appendix A), and summarized in Table 3-1.

Based on the information collected during the 2002 CSS activities, the details presented in this SAP were designed as the second step in the two step sampling program to determine remediation requirements at all properties in the Libby study area. There two objectives of the 2003 RI:

1. To complete the CSS investigation in the Libby Study area as detailed in the CSS SAP Revision 1 (CDM 2003c) concurrently with the RI procedures detailed in this SAP. The relationship between information collected during the 2002 CSS and 2003 RI sampling is presented in Figure 3-1. Figure 3-2 shows how RI sampling will be implemented concurrently with CSS activities conducted during the 2003 field season.

2. To collect information at the properties in the indoor sampling, outdoor sampling, and indoor and outdoor sampling categories to determine if remediation is or is not required.

The planning team for the RI includes Jim Christiansen (EPA RPM and decision maker), Mary Goldade (EPA project chemist), Tim Wall (CDM Libby PM for the Volpe Center), Jeff Montera (CDM RAC PM for EPA), David Schroeder (CDM onsite manager), Dee Warren (CDM RI task leader), Terry Crowell (CDM Libby sample coordinator), and Krista Lippoldt (CDM QAC).

The information will be collected during field activities between May 19 and October 31, 2003. All personnel conducting the fieldwork associated with this RI will be from CDM or subcontractors to CDM. Budget and schedules related to the project are discussed in the work plan (CDM 2003b).

The information gathered to answer the objectives will be collected from residential and commercial properties within the study area (target population). The spatial boundaries of these properties include everything between the top of the tallest structure to 6 inches below the ground surface and within each property boundary. The temporal boundaries include the time frame from when mining activities began at the mine site through the time of visual inspection and/or sampling at a property.

To collect the additional information required for remediation determinations, an inspection and sampling program using attic inspections, building material inspections, and analytical soil and dust sample results will be implemented. The following explains how each of these will be used.

- Attic inspections will be conducted to determine the presence or absence of VCI in attics that were not accessible with techniques used during the 2002 CSS and at properties where VCI was present in the past. If VCI is observed in any amount during the attic inspections, it will be assumed to be present.

- Building material inspections will be conducted at properties where vermiculite-containing building materials (VCBM) was determined to be present during the

2002 CSS investigation. The inspection will be conducted to determine if the VCBM is friable and, thus, a pathway for LA contamination in dust. If during the inspection the VCBM is determined to be friable by the techniques detailed in Section 4, the material will be assumed friable.

- Analytical results of dust and soil samples will be used to determine if sources of LA are present and if cleanup is required. The determination of cleanup actions based on soil and dust results is explained in the Response Action Work Plan (RAWP) currently being developed (CDM 2003e) and in Table 3-1.

Visible vermiculite in specific use areas (current or former flowerbeds, current or former gardens, planters, and stockpiles of vermiculite) will be remediated per the RAWP. Additional sampling will be required in other areas where visible vermiculite was noted (e.g., yard). This decision is based on two primary factors:

1. The amount of vermiculite in specific use areas tends to be higher than in the yard, as it was often used in these areas as a soil conditioner. Such areas are most likely to contain elevated levels of LA. Generally, these areas are small, present the greatest exposure risk (people working in gardens), and can be remediated quickly. EPA has made the decision that cleaning up these areas without additional sampling will be most protective in the short term and most efficient over the long term.

2. The amount of vermiculite in the yard tended to be lower than in specific use areas (in fact it may have been a few flakes over a very large area). The yard generally presents a lesser exposure risk than specific use areas and is much larger and more difficult to remediate. EPA decided that additional sampling is required for these areas to determine if LA is present and cleanup is warranted.

A range of asbestos analytical techniques is currently being considered for this investigation to identify potential LA in soil. Methods are currently being evaluated through a performance evaluation study conducted by EPA. Once the study is complete and the results reviewed, a determination will be made by EPA regarding the appropriate analytical method for soil.

The level to determine the presence or absence of LA in soil is assumed to be the reporting limit of the analytical method chosen. Again, because evaluation of soil analytical methods continues, this lower level cannot be exactly defined. At present, EPA has determined that soils exhibiting concentrations greater than or equal to 1% LA require cleanup. The rationale for choosing this concentration is presented in the DQOs of the CSS SAP Revision 1 (CDM 2003c). EPA anticipates achieving reporting limits of approximately 0.1 to 0.2%.

The preparation, reporting limit, and detection limit for dust samples is currently being developed and will be published in the Final Dust Sampling Protocol for Residential and Commercial Properties in Libby, Montana (CDM 2003d).

The practical constraints that may interfere with the collection of accurate and complete information include, but are not limited to, lack of property access, misinformation from property owner/resident, unnoticed or hidden potential LA sources, inclement weather conditions (i.e., snow-covered ground, frozen soils, overcast skies, etc.), and lack of access to attics or wall cavities. Overcast skies reduce the visibility of phyllosilicates (unexpanded vermiculite); snow prevents outdoor visual confirmation; and frozen soils limit composite soil sample homogenization.

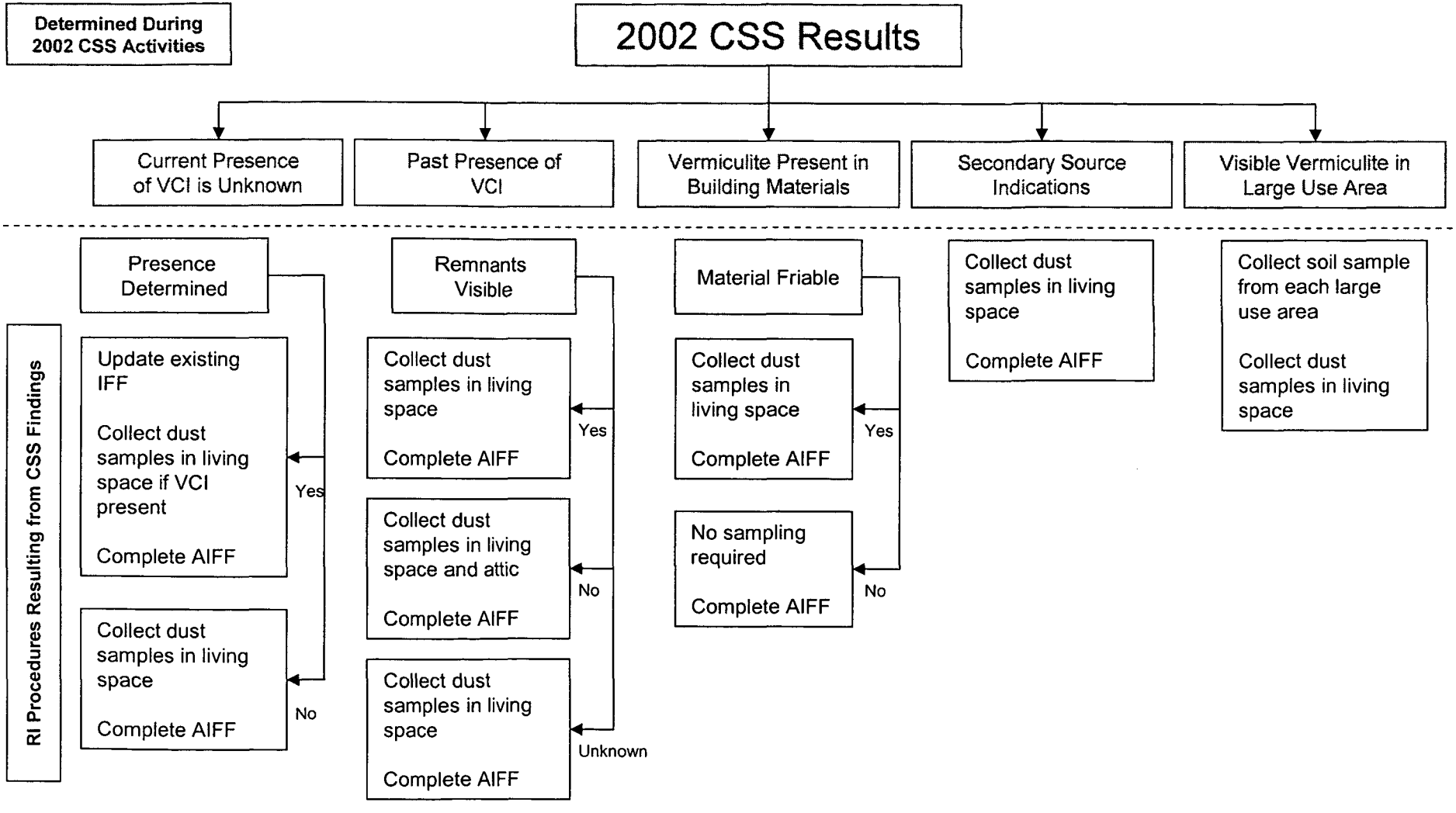
Depending on the LA source and concentration, different alternative actions may be applicable. The alternative actions that may occur at a property as a result of information gathered during the study include the following:

- Remediation of interior, which includes removal of Libby vermiculite attic insulation and cleaning
- Remediation of exterior, which includes soil removal
- No further action at this time

The determination of which decision(s) is appropriate will be made following the criteria outlined in the RAWP and summarized in Table 3-1.

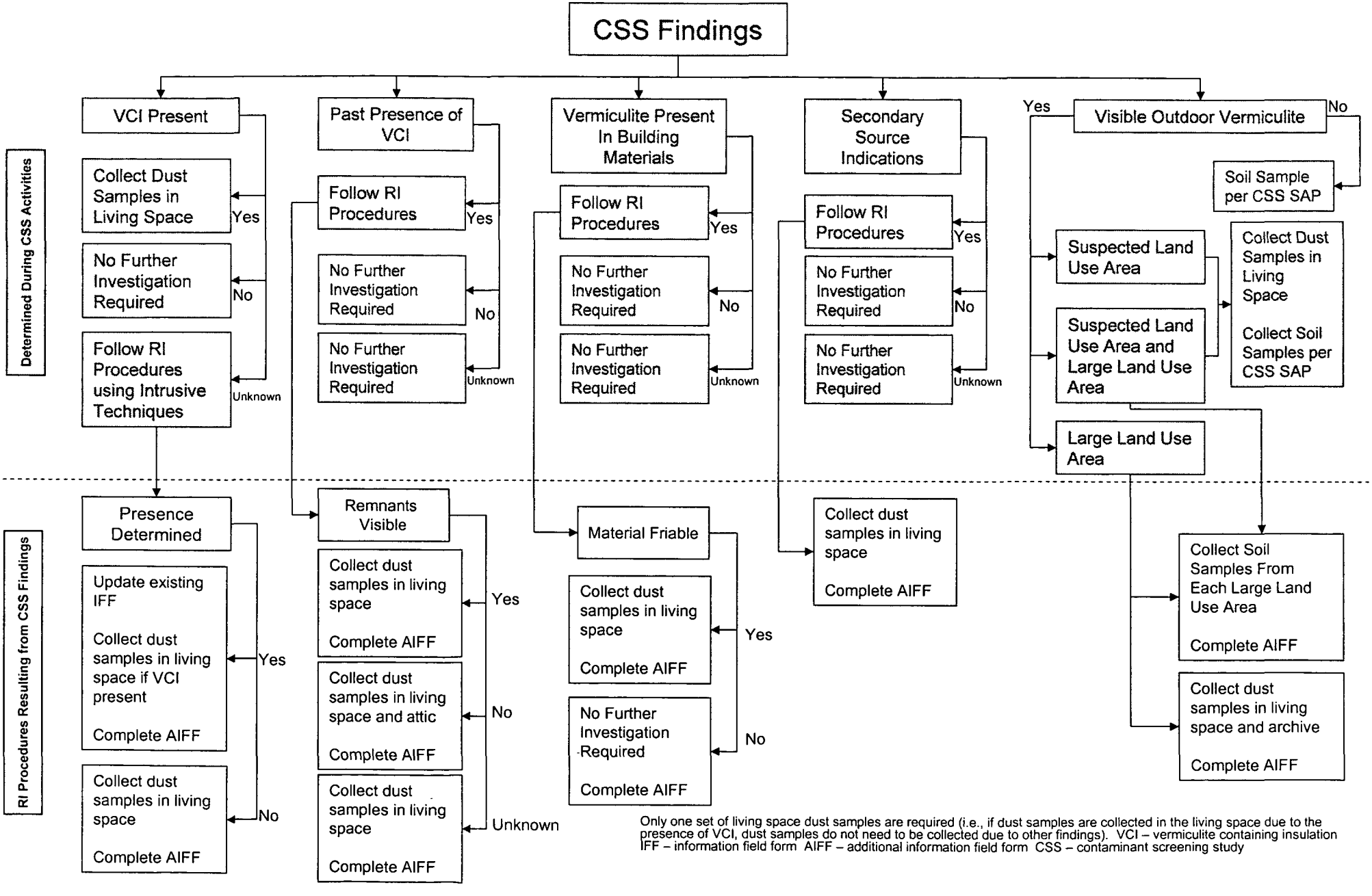
These DQOs were used to design the study/sampling process detailed in this SAP (Sections 4 and 5).

Figure 3-1: Relationship Between RI Sampling and CSS Results



Only one set of living space dust samples is required (i.e., if dust samples are collected in the living space due to the presence of VCI, dust samples do not need to be collected due to other findings). VCI – vermiculite containing insulation IFF – information field form AIFF – additional information field form CSS – contaminant screening study

Figure 3-2: Relationship Between Concurrent RI Sampling and Findings of CSS Activities



Only one set of living space dust samples are required (i.e., if dust samples are collected in the living space due to the presence of VCI, dust samples do not need to be collected due to other findings). VCI – vermiculite containing insulation IFF – information field form AIFF – additional information field form CSS – contaminant screening study

Table 3-1 Remedial and Investigation Actions Based on Remedial Action Work Plan (CDM 2003e) and from Data Collected During 2002 CSS

Decision	Category	Location	Action Criteria	Action/Action Level
Remediation Required (1,340 properties)	**Indoor remediation required (242 properties)**	VCI in attic	▪ VCI observed	▪ Remove or isolate VCI.
			▪ Observation of VCI remnants or an attic dust sample with results are greater than or equal to 5,000 LA S/cm^2	▪ Remove or isolate VCI.
		Indoor living space	▪ Visual VCI in living space	▪ HEPA vacuum and wet wipe interior living space.
			▪ Living space dust sample results with a concentration greater than or equal to 5,000 LA S/cm^2	▪ HEPA vacuum and wet wipe interior living space.
	Outdoor remediation required (742 properties)	Specific use areas	▪ Visible vermiculite	▪ Soil removal.
		Other soil areas	▪ Soil sample results with a concentration greater than or equal to 1% LA	▪ Soil removal.
	Indoor and outdoor remediation required (222 properties)	Combination of above locations	▪ See triggers identified above	▪ See actions identified above.
	Indoor remediation and outdoor sampling required (40 properties)	Combination of above locations	▪ See triggers identified	▪ See actions identified above.
	Outdoor remediation and indoor sampling required (94 properties)	Combination of above locations	▪ See triggers identified	▪ See actions identified above.
Additional Information Required (709 properties)	**Indoor sampling required (569 properties)**	Indication of secondary indoor sources in living space	▪ Current or past resident employed at Libby vermiculite mine or other Libby processing facilities	▪ Collect dust samples in living space to determine if concentration is greater than or equal to 5,000 LA S/cm^2.
			▪ Current or past resident diagnosed with an asbestos-related disease	▪ Collect dust samples in living space to determine if concentration is greater than or equal to 5,000 LA S/cm^2.
			▪ VCBM is friable	▪ Collect dust samples in living space to determine if concentration is greater than or equal to 5,000 LA S/cm^2.
		VCI in attic	▪ Presence of VCI in attic not confirmed	▪ Visually inspect attic and/or collect dust samples in living space to determine if concentration is greater than or equal to 5,000 LA S/cm^2.
			▪ VCI was present in the past	▪ Collect dust samples in attic and/or living space to determine if concentration is greater than or equal to 5,000 LA S/cm^2.
	Outdoor sampling required (83 properties)	Other soil areas	▪ Vermiculite visible over large area of property	▪ Collect soil sample from area to determine if area contains 1% LA or greater.
	Indoor and outdoor sampling required (57 properties)	Combination of above locations	▪ See triggers identified above	▪ See actions identified above.
No Remediation Required (1,103 properties)	**No remediation required (1,103 properties)**	No indications of potential LA sources	▪ VCI not present in attic ▪ VCI not present in attic in past ▪ All available dust results are less than 5,000 LA S/cm^2 ▪ No visible vermiculite in specific use areas ▪ All soil sample results are less than 1 percent LA ▪ No mining history at property ▪ No asbestos-related disease history ▪ Vermiculite not used in building materials	▪ None.

LA – Libby amphibole
S/cm^2 – structures per square centimeter
VCI – vermiculite containing insulation
VCBM – vermiculite containing building material

Section 4
Field Program Rationale, Methods, and Procedures

This section describes the RI sampling program. This program includes the collection of additional information from specific properties that require information that was not collected during the 2002 CSS activities. This additional information will determine appropriate remedial activities. Both CSS and RI investigation procedures will be implemented as new properties are investigated to complete the CSS in the study area. The approach that will be taken regarding these properties is detailed in Section 4.7.

4.1 Remedial Investigation Sampling

The information collected during the 2002 CSS activities was used to group properties into one of nine planning categories:

Remediation Required (1,340 properties)
1. Indoor remediation required (242 properties)
2. Outdoor remediation required (742 properties)
3. Indoor and outdoor remediation required (222 properties)
4. Indoor remediation and outdoor sampling required (40 properties)
5. Outdoor remediation and indoor sampling required (94 properties)

Additional Information Required (709 properties)
6. Indoor sampling required (569 properties)
7. Outdoor sampling required (83 properties)
8. Indoor and outdoor sampling required (57 properties)

No Remediation Required (1,104 properties)
9. No remediation required (1,104 properties)

The sampling activities detailed in this SAP will focus on categories 6, 7, and 8. The information collected at these properties will be used to determine remediation requirements. The process used to place properties into the nine planning categories and the interim results of the CSS are detailed in the CSS interim results report (CDM 2003a) (Appendix A).

Based on the information collected during the 2002 CSS activities, the 2003 RI program includes both continuing the CSS under the revised CSS SAP (CDM 2003c) and further investigation under this SAP. The procedures detailed in this SAP will be implemented concurrently at properties where CSS activities are conducted during 2003 and at properties in categories indoor sampling, outdoor sampling, and indoor and outdoor sampling required.

Figure 3-1 illustrates the relationship between RI sampling activities and the information obtained during the 2002 CSS activities. Figure 3-2 illustrates how RI activities will be conducted concurrently at properties with CSS activities.

The following is a summary of field activities that will be performed in accordance with this SAP by CDM personnel during the RI investigation at Libby, Montana.

- Mobilization/demobilization
- Indoor sampling and investigation
- Soil sample collection
- Equipment decontamination
- Investigation-derived waste containment and disposal
- Field documentation

The following subsections reference CDM SOPs, where applicable, or provide site-specific procedures if there are not applicable SOPs. The following SOPs (CDM 2002b) and site-specific guidance documents are included in Appendix C:

SOP 1-2	Sample Custody (with modifications)
SOP 2-1	Packaging and Shipping of Environmental Samples (with modifications)
SOP 2-2	Guide to Handling of Investigation-Derived Waste (with modifications)
SOP 4-1	Field Logbook Content and Control (with modifications)
SOP 4-2	Photographic Documentation of Field Activities (with modifications)
SOP 4-5	Field Equipment Decontamination at Nonradioactive Sites (with modifications)

Three site-specific guidance documents have been developed to standardize the completion of field forms and sample collection. These guidance documents are included in Appendix C.

CDM-LIBBY-03 Revision 1	Completion of Field Sample Data Sheets (FSDS)
CDM-LIBBY-05 Revision 1	Site-Specific SOP for Soil Sample Collection
CDM-LIBBY-06	Completion of Additional Information Field Forms (AIFF)

The HASP is included in Appendix B.

4.1.1 Mobilization/Demobilization

CDM has been supporting the activities in Libby since 1999 and currently leases office space at 318 Louisiana Avenue in Libby, Montana. As a result, the majority of

mobilization activities associated with initial setup are complete. However, startup activities for this sampling season will need to take place.

CDM will identify and provide all necessary personnel, equipment, and materials for the purpose of conducting the RI investigation. A complete inventory of available equipment and supplies will be conducted prior to initiating the field activities and any additional required equipment or supplies will be obtained. All field personnel will be trained in the field on the objectives of the RI as well as specifics on how to perform their assigned tasks.

CDM has identified the equipment and supplies necessary to support the RI field activities. These items are summarized in Table 4-1. CDM will provide all sampling equipment used to collect and contain samples for analyses. Prior to acceptance, the field team leader will inspect all supplies and consumables to ensure that they are in satisfactory condition and free of defects.

Prior to the start of field activities, a field-planning meeting will be conducted by the CDM onsite manager and attended by the available field staff, health and safety officer (HSO), field team leader, and a member of the QA staff. The CDM onsite manager will notify a member of the QA staff and field team leader of the agenda before the meeting. The agenda will be reviewed and approved by the QA staff prior to the meeting. In addition, daily field planning meetings will be held at the CDM Libby office by the CDM onsite manager and attended by the current field staff. The participants at all meetings will sign an attendance list. The field-planning meeting will discuss and clarify:

- Objectives and scope of the fieldwork
- Equipment and training needs
- Number and types of samples and analyses
- Field operating procedures, schedule of events, and individual assignments
- Required QC measures
- Safety issues
- Documents governing fieldwork that must be on site
- Community relations
- Interactions with the media
- Any changes in the field planning documents

Additional meetings will be held when the documents governing fieldwork require it or when the scope of the assignment changes significantly.

Daily field planning meetings will discuss the previous days events and planned activities for the current day. Any changes to project procedures, schedules, or other pertinent project updates will be discussed. New field team members will be introduced and assigned to work with an experienced team member.

Copies of the field-planning meeting agenda, daily field planning meeting notes, and meeting attendance lists will be distributed to the project files by the CDM project manager.

4.1.2 Indoor Sampling and Investigation

Indoor sampling and investigations will include attic inspections, building material inspections, and dust sampling.

4.1.2.1 Attic Inspections

Attic inspections will be performed at properties where the current presence of VCI is unknown or where VCI was present in the past.

Current Presence of VCI is Unknown

Intrusive techniques will be used at properties where attics could not be accessed during the 2002 CSS to determine if VCI is present. No additional investigation will be conducted at properties where attic access was denied by the property owner/resident during the 2002 CSS activities. Intrusive techniques may include removal of outside attic vents, placing a viewing scope through a current indoor or outdoor attic access, or drilling holes from the living space into the attic for placement of a viewing scope into the attic. Holes will be drilled underneath a light fixture or other unobtrusive place.

If VCI status is determined, the existing information field form (IFF) will be updated to indicate the current VCI status. The updated IFF will be given to the sample coordination team for redistribution and database update.

Dust samples will be collected in the living space if VCI is determined to be present or a determination regarding VCI cannot be made using intrusive techniques. The dust sample results will be used to determine if an interior cleaning is required at the property. The procedures used for dust sampling are detailed in Section 4.1.2.3.

All actions regarding these procedures are shown in Figures 3-1 and 3-2. All actions taken will be recorded in the field logbook. Observations will be recorded in the logbook in accordance with CDM SOP 4-1, Field Logbook Content and Control and AIFF as detailed in CDM-LIBBY-06.

Past Presence of VCI

Attic inspections will also be conducted at properties where VCI was determined to be present in the past during attic inspections (i.e., remnants of VCI observed) or verbal interviews during the 2002 CSS activities. The attic inspections will be conducted to determine if remnants of VCI are currently visible in the attic.

Observations will be made under existing insulation at the attic entry. If remnants are not observed at this location, observations will be made under existing insulation at a second location at the attic entry.

All actions regarding these procedures are shown in Figures 3-1 and 3-2. All actions taken will be recorded in the field logbook. Observations will be recorded in the logbook in accordance with CDM SOP 4-1, Field Logbook Content and Control and AIFF as detailed in CDM-LIBBY-06.

4.1.2.2 Building Material Inspections

Building material inspections will be conducted at properties where vermiculite was used in building materials. These inspections will be conducted to determine if the VCBM is friable. To determine if the material if friable, a sample of the VCBM must be used. If the material is intact and a portion cannot be obtained with minimal hand strength, the VCBM will be considered intact and no interior dust sampling will be performed. If a portion of the VCBM can be obtained with hand strength and the property owner agrees, a portion of the VCBM will be removed. A dry portion of the VCBM just large enough to fit between the index finger, middle finger, and thumb will be removed. If the material crumbles with pressure applied by fingers, the material is, by definition, friable. For the purposes of the RI, if VCBM can be removed to perform this procedure, it will be considered friable. Dust samples will be collected in all structures where VCBM is determined to be friable. The procedures used for dust sampling are detailed in Section 4.1.2.3.

All actions regarding these procedures are shown in Figures 3-1 and 3-2. All actions taken will be recorded in the field logbook. Observations will be recorded in the logbook in accordance with CDM SOP 4-1, Field Logbook Content and Control and AIFF as detailed in CDM-LIBBY-06.

4.1.2.3 Dust Sampling

Dust sampling protocol is currently being developed and will be detailed in the Final Dust Sampling Protocol for Residential and Commercial Properties in Libby, Montana (CDM 2003d).

4.1.2.4 Record GPS Locations

For each sample collected, a GPS point will be recorded. All necessary information will be entered into the GPS data dictionary.

Location identification numbers will be assigned for each sample location. Location identification numbers include sample point location identification numbers (SP) numbers and building location identification numbers (BD), as discussed below. For samples collected inside a building, (i.e. dust samples), the location identification number associated with the sample will be in the form BD-#####. This indicates which structure the sample was collected in.

4.1.3 Soil Sampling

The procedures presented in this section are brief summaries of the referenced SOPs and provide additional site-specific detail that may not be discussed in the individual SOPs. For additional information, CDM field personnel will refer to the SOPs included in Appendix C. The HASP (Appendix B) should be consulted to determine the health and safety protocol for performing specific activities.

Visible vermiculite in specific use areas (current or former flowerbeds, current or former gardens, planters, and stockpiles of vermiculite) will be remediated per the RAWP. Additional sampling will be required in other areas where visible vermiculite was noted (e.g., driveway, yard).

CSS soil sampling procedures are documented in the CSS SAP Revision 1 (CDM 2003c) and will be used for soil sampling at properties where CSS soil samples have not been collected. RI soil sampling is specific to sampling at large land use areas at properties both previously visited during past CSS activities and properties visited during the 2003 CSS activities.

Soil sampling will involve the following steps:

- Create a sketch of the property
- Segregate land use areas
- Determine sampling locations
- Collect samples
- Record sample locations using global positioning system (GPS) equipment

Create a Sketch of the Property
For properties where soils were sampled during 2002 CSS activities, a property sketch, attached to the original IFF, will show the location of soil samples collected during the 2002 CSS. Any additional soil samples collected in the large use areas (i.e. yard, driveway) will be added to the existing property sketch with the current IFF. All subsample locations for each composite sample will be identified on the sketch.

Segregate Land Use Areas
The property will be sectioned into land use areas for sampling purposes. Use areas may include, but not be limited to:

- Yard (grassy areas)
- Driveway
- Parking lot

A five-point composite sample will be collected for land areas less than or equal to 1/8 of an acre. Any land use area greater than 1/8 of an acre will require more than one composite sample.

Determine Sampling Locations
Large land use areas where vermiculite is visible will be sampled to determine if the vermiculite contains LA. Composite soil samples will be collected from similar land use areas (e.g., yard or driveway). For example, a composite yard sample will only include subsamples originating from the yard land use area (e.g., no driveway material included). Additional composite or grab samples may be collected depending on site conditions (e.g., multiple land use areas, zones, etc.). At least one composite soil sample will be collected from each of the large land use areas where vermiculite is observed. The CDM field team will use professional judgment in determining how soil samples will be collected in order to adequately characterize each land use area. In addition, if any soil samples were collected prior to the CSS, their location will be considered when sample locations for the RI are chosen. If a representative sample was collected of the use area prior to the RI, an additional sample will not be collected from that area.

For non-disturbed areas (e.g., yard), composite samples will be collected from 0 to 1 inch (in.). For disturbed areas (e.g., driveway or parking lot), composite samples will be collected from 0 to 6 in. These depths were chosen based on the site conceptual model (CDM 2003c). All composite soil samples will have no more than five subsamples (e.g., five-point composite sample). Site conditions may require that fewer subsamples be collected. This will be determined by CDM field team members.

Collect Samples
All soil samples will be collected in accordance with SOP CDM-LIBBY-05 Revision 1, Site-Specific SOP for Soil Sample Collection.

Record GPS Locations
For each sample collected, a GPS point will be recorded. Since soil samples will consist of composites, the midpoint of each composite group of samples will be recorded. All necessary information will be entered into the GPS data dictionary.

Location identification numbers will be assigned for each sample location. For each sample point collected outside a building, GPS points will be collected, and the location identification number associated with the sample point will be in the form of SP-#####.

4.1.3.1 Sample Preparation

All soil samples will be shipped to the close support facility (CSF) for further preparation (i.e., drying, splitting, archiving, etc.) in accordance with the CSF soil preparation plan (CDM 2003e). Prepared samples will be shipped to a specified laboratory for analysis.

Chain-of-custody procedures will be maintained from sample collection through the processing phase and subsequent shipping to the analytical laboratory. Prior to the shipment of any samples for analytical analysis, the laboratory coordinator will be contacted to determine the appropriate laboratory that should receive those samples.

4.1.3.2 Field Equipment Blanks

Soil samples will be collected using non-disposable equipment (i.e., trowels, bowls, spoons, etc.). Field equipment blanks are collected to determine if decontamination procedures of field equipment used to collect asbestos samples are adequate to prevent cross-contamination of samples during sample collection.

Field equipment blanks will be collected once a week from equipment used by different field teams to collect soil samples for asbestos analysis. These samples will be collected using silica sand that is asbestos free as analyzed by PLM National Institute of Occupational Safety and Health (NIOSH) Method 9002 (NIOSH 1994). Field equipment blanks will be collected by placing silica sand in a decontaminated mixing bowl used to homogenize samples. The silica sand will be mixed in the bowl using decontaminated equipment that was used to collect soil samples. The silica sand will then be submitted as a sample for preparation and analytical analysis.

4.1.3.3 Field Duplicate Samples

Soil field duplicate samples will be collected at a rate of 1 per 20 (5 percent) of the non-QC field samples. Field duplicate samples will be collected as samples co-located in the same land use area. The duplicate will be collected from the same number of subsamples as the parent sample, but the subsample locations of the duplicate sample will be randomly located in the use area. These samples will be independently collected with separate sampling equipment. These samples will be used to determine the variability of sample results in a given land use are. These samples will not be used to determine precision in sampling techniques.

4.1.4 Equipment Decontamination

Equipment used to collect, handle, or measure soil samples will be decontaminated in accordance with CDM SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites, with modifications. The following modifications to SOP 4-5 have been reviewed and approved:

Section 4.0, Required Equipment - Plastic sheeting will not be used during decontamination procedures. ASTM Type II water will not be used. Rather, locally available deionized water (DI) water will be used.

Section 5.0, Procedures - Decontamination water will not be captured and will be discharged to the ground at the property.

Section 5.6, Waste Disposal - Decontamination water will not be captured and will not be packaged, labeled, or stored as investigation-derived waste (IDW).

Decontamination procedures for soil sampling equipment will follow these steps:

- Remove all gross contamination with plastic brush
- Use DI water and a plastic brush to wash each piece of equipment
- Remove excess water present on the equipment by shaking
- Use a paper towel to dry each piece of equipment
- Wrap dried equipment in aluminum foil

Once a week all soil sampling equipment will be cleaned using Alconox and DI water.

All equipment used in attics will be wet-wiped immediate after use.

4.1.5 Investigation-Derived Waste

IDW at each property will consist of excess sample volume, spent decontamination supplies, and personal protective equipment (PPE). All IDW will be handled in accordance with CDM SOP 2-2, Guide to Handling IDW, with modifications. The following modifications to SOP 2-2 have been reviewed and approved:

Section 5.2, Offsite Disposal - All spent sampling IDW (i.e., paper towels, respirator cartridges, etc.) will be collected in transparent garbage bags and marked "IDW" with an indelible marker. These bags will be disposed of as municipal waste.

4.2 Health and Safety Air Monitoring

Air samples will be collected for health and safety. Sampling procedures are outlined in the Phase I QAPP (EPA 2000a).

4.3 Field Documentation

Detailed sampling notes will be recorded for each sample in accordance with CDM SOP 4-1, Field Logbook Content and Control. Photographic documentation will be recorded for each property in accordance with CDM SOP 4-2, Photographic Documentation of Field Activities with modifications. For each property surveyed, the BD number of the AIFF/IFF form, FSDS number, and index identification number of all samples collected will be referenced in the logbook. FSDSs, AIFF, and IFFs will be completed for each site in accordance with the CDM project-specific guidance included in Appendix C.

4.3.1 Field Logbooks and Records

Field logbooks will be maintained in accordance with SOP 4-1, Field Logbook Content and Control with modifications. The log is an accounting of activities at the Site and will duly note problems or deviations from the governing plans and observations relating to the sampling and analysis program. A new logbook page will be completed for each property visited. The header information should include the

address, the property owner's name, and primary and secondary structure BD numbers. When closing out a logbook page with lineout and signature, the author will also print his/her name underneath the signature. The sample coordinator will manage the logbooks and will send original field logbooks, as they are completed, to the CDM office in Denver, Colorado for document control. A copy of each logbook will be maintained in the CDM office in Libby, Montana and Helena, Montana.

FSDS and AIFFs will also be completed as project records of field activities. These forms will be completed in accordance with CDM-LIBBY-03 Revision 1, Completion of FSDS and CDM-LIBBY-06, Completion of AIFF.

4.3.2 Corrections to and Deviations from Documentations

Logbook modification requirements are described in CDM's SOP 4-1, Field Logbook Content and Control. For the logbooks, a single strikeout initial and date is required for documentation changes. The correct information should be entered in close proximity to the erroneous entry. These procedures will also be followed for the correction of any field form (FSDS, AIFF, IFF, and chain-of-custody [COC]). If any additional information or corrections to the original IFF completed during 2002 CSS activities are required during RI sampling activities, the correction should be made with a singlestrike out, dated, and initialed. The correct information should be entered as close as possible to the information being corrected. If information is added to the IFF as completed during the CSS, a date and set of initials should be placed next to this information.

All deviations from the guiding documents will be recorded in the logbooks and the Libby Asbestos Project Record of Deviation/Request for Modification Form (Appendix D). Any major deviations will be documented according to the quality management plan (CDM 2003f).

4.3.3 Field Sample Custody and Documentation

Sample custody and documentation will follow the requirements specified in CDM's SOP 1-2, Sample Custody and site-specific SOPs for completion of field data sheets and electronic COC (eCOC). All samples and sampling paperwork will be relinquished to the sample coordinator at the end of each day. The sample coordinator will be responsible for management of all field forms. The distribution of all field paperwork is discussed in Section 4.6.

The sample coordinator assistant will use the FSDS to complete an eCOC. The sample coordinator will check the data entered to create the eCOC against the FSDSs. Three paper copies of the eCOC will then be generated. One copy will be filed in the CDM Libby office and the other two will accompany sample shipments. The sample coordinator will check the eCOC versus the sample containers and sample shipment. The sample coordinator will be responsible for shipment of samples. If any errors are found on an eCOC after shipment, the paper copy of the COC stored in Libby will be corrected by the sample coordinator with a single strikeout, initial, and date. The

corrected copy will be faxed to Volpe and the laboratory or CSF. The fax to Volpe will be used to update the Libby project database.

4.3.4 Sample Labeling and Identification

Samples will be labeled with index identification numbers supplied by Volpe. These numbers will be maintained by the sample coordinator and signed out by sampling teams. Sample index identification numbers will identify the dust and soil samples collected during the RI by having the following format:

CS-#####

Where:

CS = Contaminant screening study
= A sequential five digit number

4.4 Chain-of-Custody Requirements

COC procedures and sample shipment will follow the requirements stated in CDM's SOP 1-2, Sample Custody and SOP 2-1, Packaging and Shipping of Environmental Samples. The COC record is used as physical evidence of sample custody and control. This record system provides the means to identify, track, and monitor each individual sample from the point of collection through final data reporting. A complete COC record is required to accompany each shipment of samples.

At the end of each day, all samples will be relinquished to the sample coordinator by the sampling team following COC procedures. The sample coordinator will follow COC procedures to ensure proper sample custody between acceptance of the samples from the field teams to shipment to the laboratory or CSF.

4.5 Sample Packaging and Shipping

Samples will be packaged and shipped in accordance with CDM's SOP 2-1, Packaging and Shipping of Environmental Samples, with modification. Custody seals will be placed over at least two sides of the cooler and then secured by tape if samples are released to a non-sampler. All samples will be shipped by an overnight delivery service to the designated laboratory. The sample coordinator will be responsible for packaging and shipment of samples. The following modifications to SOP 2-1 have been reviewed and approved:

Section 1.4, Required Equipment - Vermiculite (or other absorbent material), bubble wrap, or ice will not be used for packaging or shipping samples.

Section 1.5, Procedures - No vermiculite or other absorbent material will be used to pack the samples. No ice will be used.

4.6 Field Paperwork Distribution

The distribution of all field paperwork is discussed below and the paper work flow process at Volpe related to the data entry process is provided in Appendix E of the CSS SAP Revision 1(CDM 2003c).

Access Agreements

Original access agreements are filed in the residential folders maintained in the CDM Libby office. Obtaining a new agreement is not required for RI sampling activities. If any information on the original access agreement is changed or information added, the form will be given to the sample coordination team for redistribution. Copies will also will be sent to both the CDM Helena and CDM Denver offices for Volpe and RAC VIII project files, respectively. These copies will typically be sent each Friday by a courier service (i.e., Federal Express).

Information Field Forms

IFFs are filed in Libby by BD number. AIFFs will also be filed in Libby by BD number. If any information on the original IFF is changed or information added, the form will be given to the sample coordination team for redistribution. Copies will be filed in the residential folders maintained in the CDM Libby office. Copies will also be sent to both the CDM Helena and CDM Denver offices for Volpe and RAC VIII project files, respectively. These copies will be sent on Fridays by a courier service (i.e., Federal Express). An additional copy will be sent each Friday by a courier service to Volpe daily for data entry.

Field Sample Data Sheets

Original FSDSs will be filed in Libby by sheet number. Copies will be filed in the residential folders maintained in the CDM Libby office. Copies will also be sent to both the CDM Helena and CDM Denver offices for Volpe and RAC VIII project files, respectively. These copies will be sent on Fridays by a courier service (i.e., Federal Express). An additional copy will be faxed to Volpe daily for data entry.

Chain-of-Custody Forms

Two of the COCs will accompany samples during shipment. A copy of all COCs will be maintained in the Libby office and be filed by COC number. An additional copy will be sent to the CDM Denver office for the RAC VIII project files. These copies will be sent on Fridays by a courier service (i.e., Federal Express). In addition, eCOCs will be sent to Volpe daily for upload into the Libby project database.

Logbooks

As logbooks are completed, originals will be sent to the CDM Denver office for the RAC VIII project files. Copies will be maintained in the CDM Helena office (for Volpe project files) and in the Libby office. In addition, pages relevant to a specific property will be maintained in the residential file folders in the Libby office.

Data Packages and Data Validation Reports

Original data packages and data validation reports will be filed in the CDM Denver office in the RAC VIII project files. Copies will be maintained in the CDM Helena office in Volpe project files.

4.7 CSS and RI Activities Conducted Concurrently

RI procedures will be conducted concurrently at properties where CSS activities are conducted during the 2003 field season. The RI procedures conducted will be dependent on the finding of the CSS activities, as illustrated in Figure 3-2.

4.8 Sample Analysis and Data Validation

Soil samples will be prepared and analyzed according to the CSS SAP Revision 1 (CDM 2003c). EPA is currently developing data validation criteria for soil sample results. When these procedures are established, the CSS SAP Revision 1 (CDM 2003c) will be amended to include these procedures.

The preparation, reporting limit, and detection limit for dust samples is currently being developed and will be published in the Final Dust Sampling Protocol for Residential and Commercial Properties in Libby, Montana (CDM 2003d).

Table 4-1 Sampling Supply and Equipment Checklist

General	
Sampling and analysis plan	Alconox
Access agreement forms (completed and blank)	Water sprayer
Information field forms (screening questionnaire)	Scrubbing brush
Field logbook	De-ionized water
Field Sample Data Sheets	Aluminum foil
Chain-of-custody (COC) forms	Paper towels
Sheets of index IDs	Measuring tape
Sheets of location IDs	Tape - clear, duct, and strapping
GPS unit	Ice chests (2)
Digital camera	Garbage bags (transparent)
Trowel or bulb planter	Ladder
Mixing bowl/spoons	Flashlight
Zip-top plastic bags (quart size)	Information flyer (to be left with property owner)
Indelible markers and pens (Sharpie, extra fine)	Tygon tubing
SKC Air pumps	Air pump calibrator (dry-cal)
Microvacuum sampling cassettes	Clipboards
Decon buckets - 5 gallon	
Health and Safety	
First aid kit	Steel-toed boots
Tyvek coveralls	Gloves - cotton and nitrile
Respirator and cartridges (see HASP)	Respirator cleaning wipes
Safety glasses	Cellular telephone/radio
Fire extinguisher	High efficiency particulate air vacuums

Section 5
Laboratory Analysis and Requirements

The laboratory analysis and requirements for soil samples are detailed in the CSS SAP Revision 1 Section 6 (CDM 2003c). Soil samples collected under this SAP will follow those procedures. This section will only detail requirements associated with dust sample analysis. The laboratories used for all sample analyses will have participated in, and acceptably analyzed, the required parameters in the last two proficiency examinations from both the National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program (NIST/NVLAP). In addition, the laboratory must participate in the laboratory training program developed by the Libby laboratory team. The current outline for this training program is provided in Appendix F of the CSS SAP Revision 1 (CDM 2003c) but is expected to be updated periodically as it is part of a continuous improvement program for analysis of Libby samples.

5.1 Analytical Methods

A range of asbestos analytical techniques are currently being considered for this investigation to identify potential LA in soil. Methods are currently being evaluated through a performance evaluation study conducted by EPA. Once the study is complete and the results reviewed, a determination will be made regarding the appropriate analytical method for soil. Once an analytical approach has been finalized, this SAP will be amended.

The analytical method for dust samples is currently being developed and will be published in the Final Dust Sampling Protocol for Residential and Commercial Properties in Libby, Montana (CDM 2003d).

The analytical laboratories that will be utilized to analyze soil and dust samples for the RI are listed below:

Batta
Delaware Industrial Park
6 Garfield Way
Newark, Delaware 19713-5817

EMSL Mobile Lab
107 W 4th St
Libby, Montana 59923

EMSL Westmont
107 Haddon Ave
Westmont, New Jersey 08108

Hygeia
82 W Sierra Madre Blvd
Sierra Madre, California 91024-2434

Reservoirs
2059 Bryant St
Denver, Colorado 80211

MAS
3945 Lakefield Ct
Suwannee, Georgia 30024

5.2 Reporting Limits

The reporting limit for soils has not been established. Once an analytical method is determined based on the performance evaluation study and a reporting limit is determined, this SAP will be amended.

The reporting limit and detection limit for dust samples is currently being developed and will be published in the Final Dust Sampling Protocol for Residential and Commercial Properties in Libby, Montana (CDM 2003d).

5.3 Holding Times

Technical holding times are storage times allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed. No preservation requirements or holding times are established for dust samples collected for asbestos analysis.

5.4 Laboratory Custody Procedures and Documentation

Laboratory custody procedures are provided in the laboratories' QA management plan, which are approved by CDM as part of the laboratory procurement process. Upon receipt at the laboratory, each sample shipment will be inspected to assess the condition of the shipping and the individual samples. This inspection will include verifying sample integrity. The enclosed COC records will be cross-referenced with all of the samples in the shipment. The laboratory sample custodian will sign these records and provide copies for placement in the project files. The sample custodian may continue the COC record process by assigning a unique laboratory number to each sample on receipt. This number, if assigned, will identify the sample through all further handling at the laboratory. It is the laboratory's responsibility to maintain internal logbooks and records throughout sample preparation, analysis, and data reporting.

5.5 Laboratory Quality Assurance Program

Samples collected during this project will be analyzed in accordance with standard EPA and/or nationally recognized analytical procedures (i.e., Good Laboratory Practices [GLP]). The purpose of using standard procedures is to provide analytical

data of known quality and consistency. Analytical laboratories will be provided a copy of and will adhere to the requirements of this SAP.

5.6 Documentation and Records

Data reports for dust samples will be submitted to the CDM laboratory coordinator and include a case narrative that briefly describes the number of samples, the analyses, and any analytical difficulties or QA/QC issues associated with the submitted samples. The data report will also include signed chain-of-custody forms, analytical data, a QC package, and raw data, where applicable. Raw data is to consist of instrument preparation logs, instrument printouts, and QC sample results including, instrument maintenance records, COC check in and tracking, raw data instrument print outs of sample results, analysis run logs, and sample preparation logs. All original data reports will be filed in the CDM office in Denver, Colorado and a copy filed in the CDM office in Helena, Montana. The laboratory also will provide an electronic copy of the data to the laboratory coordinator and others as directed by CDM.

5.7 Data Management

Sample results will be delivered to Volpe and CDM's Cambridge office both in hard copy and as an electronic data deliverable (EDD). In addition, original data packages and data validation reports will be filed in the CDM Denver office in the RAC VIII project files. Copies will be maintained in the CDM Helena office in the Volpe project files.

Electronic copies of all project deliverables, including graphics, will be filed by project number. Electronic files will be routinely backed up and archived.

All results, field data sheet information, and IFF forms will be maintained in the Libby project database managed by Volpe. The distribution of all paperwork is discussed in Section 4.6.

Section 6
Quality Assurance/Quality Control Program

The field QA program has been designed in accordance with CDM's RAC VIII Quality Management Plan (QMP) (CDM 2003f), EPA's Guidance for the DQO Process (EPA 2000b), and EPA's Requirements for QAPPs for Environmental Data Operations, QA/R-5, Final (EPA 2001b).

A QA/QC program has been developed for the RI to ensure that the quality of the data collected in the field can be assessed. This section outlines where in the RI process potential data quality problems can occur, what QA/QC measures are in place to monitor any problems, and what corrective actions will be taken to address those problems.

6.1 Remedial Investigation Sampling

QA/QC procedures can be found at each step within the RI process. The QA/QC measures associated with the RI are discussed below, followed by a detail of the study process, the potential problems with each step of the study process, the QA/QC measures designed to mitigate the problems, and the corrective actions to prevent reoccurrence of problems.

Field Team Orientation

Due to the longevity of the RI, several field team members will rotate shifts throughout the field effort. CDM will make a conscious effort to utilize personnel (when available) with prior experience in performing similar activities during the Libby Asbestos Project Phase I and CSS investigations. All RI team members will be required to participate in an orientation, which will cover the overall RI process, personal communication skills, sample collection protocols, and identification of primary and secondary contamination sources.

All field team members and the quality assurance manager (QAM) will be required to sign a required reading form indicated they have read and understand this SAP, and participate in a field team orientation, which will include discussing the RI investigation approach, sampling techniques, communication skills, access form completion, identification of primary and secondary LA sources, and proper completion of all field forms.

Field Form Completion Checks

All field forms (AIFF, IFF, FSDS) will be completed in the field before leaving a property. To ensure that all applicable data is entered and all necessary fields are completed, a different field team member will check each field form. The RI task leader will also complete daily checks of all field forms.

Supplemental Verification

Supplemental verification of vermiculite product will be performed when the field team cannot identify, with confidence, vermiculite and/or primary sources of LA product. The RI task leader will meet the field team at the property to assist in the identification process.

Screening Field Checks

Screening field checks will also be conducted by the RI task leader. The RI task leader will accompany the RI team during an investigation. The team will be critiqued on performance and data collection procedures. Screening field checks will be conducted at a rate of 2 percent (1 per 50) of the properties investigated.

Field Audits

A field audit will be performed during the first month of the field effort. If significant RI procedural changes occur during the study, additional field audits will be conducted to ensure the new methods are implemented and followed appropriately. In addition, opportunistic audits may be necessitated by the findings of screening field checks completed by the RI task leader. The QAM will be the point of contact for the field audit and be responsible for overseeing implementation of any corrective actions required or as requested by EPA. Field audit reports will be completed following each audit. This report is a CDM internal document and will be maintained in the RAC VIII project files in Denver; a copy of the audit report, as well as any corrective action reports, will be provided to EPA. The field audit will be conducted and reported in accordance with the CDM QA Manual, Revision 10 (CDM 2002c) and the QA Auditors Handbook (CDM 2000).

Field Duplicate Samples

Soil field duplicate samples will be collected at a rate of 1 per 20 (5 percent) of the field samples. Field duplicate samples will be collected as samples co-located in the same land use area. The duplicate will be collected from the same number of subsamples as the parent sample, but the subsample locations of the duplicate sample will be randomly located in the use area. These samples will be independently collected with separate sampling equipment. These samples will be used to determine the variability of sample results in a given land use are. These samples will not be used to determine variability in sampling techniques.

Field Equipment Blanks

Field equipment blanks will be collected once a week from equipment used by different field teams to collect soil samples for asbestos analysis. These samples will be collected using silica sand that is asbestos free as analyzed by PLM. Field equipment blanks will be collected by placing silica sand in a decontaminated mixing bowl used to homogenize samples. The silica sand will be mixed in the bowl using decontaminated equipment that was used to collect soil samples. The silica sand will then be submitted as a sample for analytical analysis.

Dust Field Blanks

Field blanks will be collected at a frequency of 1 per 20 field samples (5 percent). These samples are prepared by opening the end of a microvaccum cartridge at a sampling location and exposing to air for 5 seconds. The end is then closed and the sample submitted for analysis.

Dust Lot Blanks

Lot blanks will be submitted for each lot of microvaccum cartridges received prior to using to collect field samples. Lot blanks are submitted to ensure cartridges are received asbestos free.

Preparation Duplicate Samples

Preparation duplicate samples are splits of samples submitted for sample preparation prior to laboratory analysis. These samples serve to evaluate the precision of both the sample preparation process and the laboratory's sample preparation and analysis. A preparation duplicate sample should be submitted at a frequency of 5 percent of the field samples prepared for analysis or one per preparation batch, whichever is more frequent. The acceptable criteria for a preparation duplicate are currently being developed.

Preparation Laboratory Equipment Blanks

Preparation laboratory equipment blank samples are collected to determine if decontamination procedures of laboratory equipment used to prepare asbestos samples are adequate to prevent cross-contamination of samples during sample preparation. Preparation laboratory equipment blanks will be collected at the end of each day of sample preparation from equipment used to prepare samples for asbestos analysis. These samples will be collected using silica sand that is asbestos free as analyzed by PLM. Silica sand will be prepared the same way a soil sample submitted from the field is prepared for analysis by the preparation laboratory. The silica sand will then be submitted as a sample for analytical analysis. The frequency of laboratory equipment blank sample collection may be adjusted, as the relationship between cross-contamination and sample results is understood. If the required frequency is adjusted, the change and supporting rationale will be documented as described in Section 4.3.2.

Grinding blank samples are prepared to determine if decontamination procedures of laboratory equipment used to prepare asbestos samples are adequate to prevent cross-contamination of samples during sample grinding and splitting. The grinding blank will consist of clean quartz sand and will be processed once per day, on days that field samples are ground. The grinding blank samples are given sample identification numbers provided to the CSF by sample coordination personnel in Libby, Montana. For each grinding blank prepared, an FSDS is completed as detailed in the CSS SAP, and a copy is sent to the sample coordinator and Volpe.

Data Entry Checks

Data entry into the Libby project database is performed by Volpe with a 100 percent QC of the data. This check will be performed on a daily basis on the data entered from the previous day.

6.1.1 Field Documentation

Detailed field documentation and recordkeeping of the RI field activities are required as detailed in Section 5.2. Documentation involves field logbooks and records, corrections to documentation, sample labeling and identification, COC requirements, and field paper work distribution. The potential problems and corrective actions associated with field documentation are presented below.

Potential Problem	QA/QC Measure	Corrective Action
Field Logbook and Records		
Incorrect completion of field logbook	Field team orientation	Reorientation of field logbook completion procedures.
	Field form completion checks	Reorientation of logbook completion procedures and additional checks of logbooks completed by the same team.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
	Screening field checks	Reorientation of logbook completion procedures and additional checks of logbooks completed by the same team.
Incorrect document correction procedures	Field team orientation	Reorientation of document correction procedures.
	Field form completion checks	Reorientation of document correction procedures and additional checks of field documents completed by the same team.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
	Screening field checks	Reorientation of document correction procedures and additional checks of field documents completed by the same team.
Incorrect sample labeling and identification	Field team orientation	Reorientation of sample labeling and identification procedures.
	Field form completion checks	Reorientation of sample labeling and identification procedures and additional checks of samples labeled by the same team.

	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
	Screening field checks	Reorientation of sample labeling and identification procedures and additional checks of samples labeled by the same team.

6.1.2 Remedial Investigation Sampling and Investigations

The field screening process at each property will consist of both a qualitative (i.e., attic and VCBM inspections) and quantitative (i.e., dust and soil sampling) approach. The potential problems, QA/QC measures implemented, and corrective actions for each approach are presented below.

Potential Problem	QA/QC Measure	Corrective Action
Attic Inspections		
Incorrect update of field form (IFF) from attic inspection results	Field team orientation	Reorientation of IFF completion procedures.
	Field form completion checks	Reorientation of IFF procedures and additional checks of IFFs completed by the same team. Resubmit IFFs requiring correction to Volpe for revised data entry.
	Screening field checks	Reorientation of IFF procedures and additional screening field checks of inspections completed by the same team. Resubmit IFFs requiring correction to Volpe for revised data entry.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect completion of AIFF	Field team orientation	Reorientation of AIFF completion procedures.
	Field form completion checks	Reorientation of AFF procedures and additional checks of AIFFs completed by the same team. Resubmit AIFFs requiring correction to Volpe for revised data entry.
	Screening field checks	Reorientation of AIFF procedures and additional screening field checks of inspections completed by the same team. Resubmit AIFFs requiring correction to Volpe for revised data entry.

Potential Problem	QA/QC Measure	Corrective Action
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect identification of VCI	Field team orientation	Reorientation of primary source identification
	Field form completion checks	Reorientation of primary source identification and additional screening field checks of inspections completed by the same team. Resubmit affected paperwork requiring correction to Volpe for revised data entry.
	Supplemental verification	Reorientation of primary source identification and additional screening field checks of inspections completed by the same team. Resubmit affected paperwork requiring correction to Volpe for revised data entry.
	Screening field checks	Reorientation of primary source identification and additional screening field checks of inspections completed by the same team. Resubmit affected paperwork requiring correction to Volpe for revised data entry.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect completion of field logbook	Field team orientation	Reorientation of field logbook completion procedures.
	Field form completion checks	Reorientation of logbook completion procedures and additional checks of logbooks completed by the same team.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
	Screening field checks	Reorientation of logbook completion procedures and additional checks of logbooks completed by the same team.
Building Material Inspections		
Incorrect completion of AIFF	Field team orientation	Reorientation of AIFF completion procedures.
	Field form completion checks	Reorientation of AFF procedures and additional checks of AIFFs completed by the same team. Resubmit AIFFs requiring correction to Volpe for revised

Potential Problem	QA/QC Measure	Corrective Action
		data entry.
	Screening field checks	Reorientation of AIFF procedures and additional screening field checks of inspections completed by the same team. Resubmit AIFFs requiring correction to Volpe for revised data entry.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect identification of friable material	Field team orientation	Reorientation of primary source identification
	Supplemental verification	Reorientation of primary source identification and additional screening field checks of inspections completed by the same team. Resubmit affected paperwork requiring correction to Volpe for revised data entry.
	Screening field checks	Reorientation of primary source identification and additional screening field checks of inspections completed by the same team. Resubmit affected paperwork requiring correction to Volpe for revised data entry.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect completion of field logbook	Field team orientation	Reorientation of field logbook completion procedures.
	Field form completion checks	Reorientation of logbook completion procedures and additional checks of logbooks completed by the same team.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
	Screening field checks	Reorientation of logbook completion procedures and additional checks of logbooks completed by the same team.
Dust Sampling		
Incorrect completion of field form (FSDS) for sample collection	Field team orientation	Reorientation of FSDS completion procedures.
	Field form completion checks	Reorientation of FSDS completion procedures and additional checks of FSDSs

Potential Problem	QA/QC Measure	Corrective Action
		completed by the same team. Resubmit FSDSs requiring correction to Volpe for revised data entry.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect completion of field logbook	Field team orientation	Reorientation of logbook completion procedures.
	Field form completion checks	Reorientation of logbook completion procedures and additional checks of logbooks completed by the same team.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect completion of COC	Field team orientation	Reorientation of COC completion procedures.
	Field form completion checks	Reorientation of COC completion procedures and additional checks on COCs completed by the same team. Resubmit COCs requiring correction to Volpe for revised data entry and contact laboratory by fax or e-mail (to document the problem) and issue revised COC.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect documentation of changes to study process	Screening field checks	Review process for documentation of changes to the study process, and complete required documentation.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect recording of GPS locations	Field team orientation	Reorientation of GPS recording procedures.
	Screening field checks	Reorientation of GPS recording procedures.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect determination of sampling locations	Field team orientation	Reorientation of sample location selection process.
	Screening field checks	Reorientation of sample location selection process.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect sample collection techniques	Field team orientation	Reorientation of sample collection procedures.
	Field equipment blanks	Reorientation of decontamination

Potential Problem	QA/QC Measure	Corrective Action
		procedures and qualification of data as described by data validation procedures.
	Field duplicates	Reorientation of sample collection procedures and qualification of data as described by data validation procedures.
	Preparation duplicates and laboratory equipment blank samples	Discussion with preparation laboratory regarding procedure.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect packaging and COC during shipment of samples	Field team orientation	Reorientation of COC procedures.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect information entered into the database	Data entry checks	Notify Volpe of errors and perform additional checks on data entered.
Soil Sampling		
Incorrect completion of field form (FSDS) for sample collection	Field team orientation	Reorientation of FSDS completion procedures.
	Field form completion checks	Reorientation of FSDS completion procedures and additional checks of FSDSs completed by the same team. Resubmit FSDSs requiring correction to Volpe for revised data entry.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect completion of field logbook	Field team orientation	Reorientation of field logbook completion procedures.
	Field form completion checks	Reorientation of logbook completion procedures and additional checks of logbooks completed by the same team.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect update to existing IFF to show additional sample locations	Field team orientation	Reorientation of field IFF completion procedures.
	Field form completion checks	Reorientation of IFF completion procedures and additional checks of IFFs completed by the same team.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect completion of COC	Field team orientation	Reorientation of COC completion

Potential Problem	QA/QC Measure	Corrective Action
		procedures.
	Field form completion checks	Reorientation of COC completion procedures and additional checks on COCs completed by the same team. Resubmit COCs requiring correction to Volpe for revised data entry and contact laboratory by fax or e-mail (to document the problem) and issue revised COC.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect documentation of changes to study process	Screening field checks	Review process for documentation of changes to the study process, and complete required documentation.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect decontamination procedures	Field team orentation	Reorientation of decontamination procedures.
	Field equipment blanks	Reorientation of decontamination procedures and qualification of data as described by data validation procedures.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect recording of GPS locations	Field team orientation	Reorientation of GPS recording procedures.
	Screening field checks	Reorientation of GPS recording procedures.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect determination of sampling locations	Field team orientation	Reorientation of sample location selection process.
	Screening field checks	Reorientation of sample location selection process.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect sample collection techniques	Field team orientation	Reorientation of sample collection procedures.
	Field equipment blanks	Reorientation of decontamination procedures and qualification of data as described by data validation procedures.
	Field duplicates	Reorientation of sample collection procedures and qualification of data as described

Potential Problem	QA/QC Measure	Corrective Action
		by data validation procedures.
	Preparation duplicates and laboratory equipment blank samples	Discussion with preparation laboratory regarding procedure. If RPD continues to be above 35 percent or consistent problems with the equipment blank occur, a laboratory audit may be performed.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Incorrect packaging and COC during shipment of samples	Field team orientation	Reorientation of COC procedures.
	Field audit to assess compliance of this study step with the SAP	Implement corrective actions of field audit.
Inadequate sample preparation procedures	Preparation duplicates and laboratory equipment blank samples	Discussion with preparation laboratory regarding procedure. If RPD continues to be above 35 percent, a laboratory audit may be performed.
Incorrect information entered into the database	Data entry checks	Notify Volpe of errors and perform additional checks on data entered.

6.1.3 Sample Analysis and Data Validation

The data validation criteria for soil results are currently under development. Once the criteria are developed, the CSS SAP will be amended to include this information. Dust results will not be validated.

The QA/QC measures associated with this RI step, as associated with dust results, are discussed below followed by a detail of the potential problems with this study step, the QA/QC measures designed to mitigate the problems, and the corrective actions to prevent reoccurrence of problems.

Laboratory Training

A laboratory training program developed by EPA will be implemented at the laboratories utilized to analyze samples for the RI. The training will be for new analysts and new equipment.

Laboratory Audits

Laboratories utilized to analyze samples collected as part of the RI will be required to provide proof of current certifications. Examples of certifications include the following: American Industrial Hygiene Association and NVLAP. If laboratory QC controls show consistent problems in the data validation process, a laboratory audit may be performed.

Data Entry Checks

Data entry into the Libby project database is performed by Volpe with a 100 percent QC of the data.

CDM Document Review Process

All project deliverables will receive technical and QA reviews prior to being issued to EPA. These reviews will be conducted in accordance with CDM's Quality Procedure (QP) 3.2, Technical Document Review and QP 3.3, Quality Assurance Review (CDM 2002c). Completed review forms will be maintained in the project files.

Potential Problem	QA/QC Measure	Corrective Action
Incorrect analytical results entered into the database	Data entry checks	Notify Volpe of errors and perform additional checks on data entered.
Incorrect information in residential/owner followup letter	CDM document review process	Make corrections to document.

Every reasonable attempt will be made to obtain a complete set of usable field measurements and analytical data. If a measurement cannot be obtained or is rejected for any reason, the CDM project manager and CDM QA staff will evaluate the effect of the missing data in a real-time manner such that appropriate corrective action procedures can be implemented.

6.2 Assessment and Oversight

Assessments and oversight reports to management are necessary to ensure that procedures are followed as required and that deviations from procedures are documented. These reports also serve to keep management current on field activities. Assessment and oversight reports are discussed below.

6.2.1 Assessments and Response Actions

Performance assessments are quantitative checks on the quality of a measurement system and may be used for analytical work. System assessments are qualitative reviews of different aspects of project work to check on the use of appropriate QC measures and functioning of the QA system. When a project exceeds 1 year, an office system assessment is required. One office system assessment is scheduled for 2003.

Performance assessments for the laboratory may be accomplished by submitting reference material as blind reference (or performance evaluation) samples. These assessment samples are samples with known concentrations that are submitted to the laboratory without informing the laboratory of the known concentration. Samples will be provided to the laboratory for performance assessment upon request from the EPA RPM. Laboratory audits may also be conducted upon request from the EPA RPM. CDM will be responsible for tracking the quality of data received from laboratories by performing data validation. If during the data validation process

consistent quality issues are discovered, CDM may recommend a laboratory audit be performed.

Response actions will be implemented on a case-by-case basis to correct quality problems. Minor response actions taken in the field to immediately correct a quality problem will be documented in the applicable logbook and verbally reported to the CDM project manager. For verbal reports, the CDM project manager will complete a communication log to document that response actions were relayed to him. The CDM project manager and the EPA RPM will approve major response actions taken in the field prior to implementation of the change. Major response actions are those that may affect the quality or objective of the investigation. Quality problems that cannot be corrected quickly through routine procedures (i.e., those resulting from an audit or those that signify an adjustment to the planning documents resulting from the audit) require implementation of a Corrective Action Request (CAR) Form. Corrective action forms will be implemented in accordance with CDM's QP 8.1, Correction Action (CDM 2002c).

All formal response actions will be submitted to either CDM's RAC Region VIII regional QA coordinator or RAC local QA coordinator for review and issuance. CDM's project manager or project QA coordinator will notify the QA manager or regional QA coordinator when quality problems arise that may require a formal response action.

6.2.2 Reports to Management

The QAM will provide biweekly reports to the CDM project managers that detail the QA procedures conducted in the field and any corrective actions taken. The outline the QAM reports will follow is presented in Appendix F. The QA reports will be provided to management whenever quality problems are encountered. Field staff will note any quality problems in the field logbooks. CDM's project manager will inform the project QA coordinator upon encountering quality issues that cannot be immediately corrected. Monthly QA reports will be submitted to CDM's RAC Region VIII QA manager by the local QA coordinator and the RAC regional QA coordinator. Topics to be summarized regularly may include but not be limited to: technical and QA reviews that have been conducted, activities and general program status, project meetings, corrective action activities, any unresolved problems, assessment of data deficiencies, and any significant QA/QC problems not included above.

6.3 Reconciliation with Data Quality Objectives

Once data has been generated, CDM will evaluate that analytical data for data quality assessment and adherence to the DQOs.

Section 7
References

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Appendix A
CSS Interim Results Report

To be included when finalized.

Appendix B
Site Health and Safety Plan

Health and Safety Plan Form	Environmental Protection Agency -- Region 8 --	CDM Federal Programs Corporation
		Project Document No.: 3282-137-PP-HASP

Project Name	Libby Asbestos Superfund Site OU4	**Work Assignment No.**	137-RIRI-08BC **Region** 8
Job Site Address	All properties within Libby Valley, encompassing	**Client**	U. S. Environmental Protection Agency
	Approx. 192 sq. miles including the City of Libby and areas where Libby amphibole asbestos contamination has historically been found. This sampling effort is designed to investigate all properties within the Libby Valley and will include a verbal and visual investigation. CDM project office: 318 Louisiana Ave, Libby, Montana 59923	**Project**	Libby Asbestos RI OU4 - Contaminant Screening Study
Site Contact	Dave Schroeder	**EPA Client Contact**	Jim Christiansen, EPA RPM
Phone No.	406-293-8595 or 406-293-3388	**Phone No.**	303-312-6748

■ **Amendment No.** 1 **to Existing Approved HSP - Date Existing Approved HSP** 4/1/02

Objectives of Field Work:

The purpose of this sampling effort is to collect information to fill data gaps and to determine if properties require remediation. Data obtained for this investigation will include attic inspections, building material inspections, dust sampling, and onsite soil sampling from suspected contaminated areas. Results of this investigation will be used to facilitate any immediate removal actions deemed necessary by the EPA and for future project management decisions.

Type: Check as many as applicable

☐ Active	☐ Landfill	☐ Unknown
■ Inactive	■ Uncontrolled	☐ Military
■ Secure	■ Industrial	■ Other **specify**: Since this RI will occur on all properties in the Libby Valley, facility types will vary greatly.
■ Unsecure	☐ Recovery	
☐ Enclosed space	☐ Well Field	

Description and Features: Summarize below. Include principal operations and unusual features (containers, buildings, dikes, power lines, hills, slopes, river)

The Town of Libby is located in the extreme northwest corner of Montana. According to historical mining records, 80 percent of the world's vermiculite came from the Zonolite Mountains in Libby, Montana. EPA has determined that the vermiculate ore that was mined from these mountains is contaminated with Libby amphibole asbestos. This ore was shipped throughout the United States both as processed and unprocessed material. EPA has been conducting various investigations to determine potentially contaminated properties within Libby, which may have resulted from the Libby mining operations. This amphibole asbestos is suspected of affecting the health of the residents at various sites from numerous locations. The properties associated with this investigation may be contaminated with Libby amphibole asbestos from introduced sources. Properties include residential and small commercial areas and vary in size. Potential source materials include attic insulation and contaminated soils.

Surrounding Population: ■ Residential ■ Industrial ■ Rural ■ Urban ☐ Other:

This Page Reserved for Map (Show Exclusion, Contamination Reduction, and Support Zones. Indicate evacuation and reassembly points.)

See Figures 2-2 in SAP text.

History: Summarize below. In addition to history, include complaints from public, previous agency actions, known exposures or injuries, etc.

The Zonolite Mine began operation in 1924 by owner Edward Alley. In 1925, Great Northern Railroad shipped the first boxcar of "Zonolite" from Libby to an Ohio company that used it to insulate bank vaults, office safes, and filing cabinets. Other firms used the material to make building boards and roofing materials. Processing the material was a straightforward process. The vermiculite ore was stripped from the mine and hauled in trucks to a mill, where it was separated into various commercial sizes through a screening system. Some of the ore was shipped unprocessed. Other material was sent to an expansion plant where it was processed in ovens at about 2,000 degrees, causing it to expand to 15 times its original size. In 1939, Zonolite merged with another company mining at the bottom of the hill that eventually became known as the Zonolite Co. In 1963, the company was sold to W.R. Grace and Co. who expanded the operation and increased production. Through the 60s, 70s, and 80s, millions of tons of vermiculite ore was hauled by rail to Grace plants and other companies in 30 states and 6 foreign countries. At one time, 80 percent of the world's vermiculite came from Libby. The W.R. Grace Company, which owned the mine for 30 years, closed it in 1990 and sold the property 4 years later.

Waste Types: ☐ Liquid ■ Solid ☐ Sludge ☐ Gas ☐ Unknown ☐ Other **Specify**:

Waste Characteristics: Check as many as applicable.

☐ Corrosive	☐ Flammable	☐ Radioactive*
■ Toxic	☐ Volatile	☐ Reactive
☐ Inert Gas	☐ Unknown	■ Other **specify**: Carcinogenic

Work Zones: Describe the Exclusion, Contamination Reduction, and Support Zones in terms onsite personnel will recognize.

Work zones will be used during intrusive attic inspections and soil sampling. The exclusion zone will be areas in close proximity to the intrusive work zone or soil sampling areas. The contamination reduction zone will be demarcated by the decontamination station set up at each sampling site. The support zone will be considered the 10-foot perimeter around support vehicles.

Hazards of Concern:

■ Heat Stress attach guidelines	☐ Noise:
■ Cold Stress attach guidelines	☐ Inorganic Chemicals
☐ Explosive/Flammable	☐ Organic Chemicals
☐ Oxygen Deficient	■ Motorized Traffic
☐ Radiological	☐ Heavy Machinery:
■ Biological: stinging insects, venomous reptiles	■ Slips, Trips, and Falls

■ Other **Specify**: Inhalation of particulate matter

Principle Disposal Methods and Practices: Summarize below:

The unused or below-grade material was disposed of by throwing it in piles around the facility. According to the previous site visit, there were no visible stockpiles of product that still exists.

Health and Safety Plan Form	Environmental Protection Agency -- Region 8 --	CDM Federal Programs Corporation

Hazardous Material Summary: Circle waste type and estimate amounts by category

Chemicals Amounts/Units:	*Solids Amounts/Units:*	*Sludges Amounts/Units:*	*Solvents Amounts/Units:*	*Oils Amounts/Units:*	*Other Amounts/Units:*
☐ Acids	☐ Flyash	☐ Paint	☐ Halogenated (chloro, bromo)	☐ Oily Wastes	☐ Laboratory
☐ Pickling Liquors	■ Asbestos	☐ Pigments	☐ Solvents	☐ Gasoline	☐ Pharmaceutical
☐ Caustics	☐ Milling/Mine Tailings	☐ Metal Sludges	☐ Hydrocarbons	☐ Diesel Oil	☐ Hospital
☐ Pesticides	☐ Ferrous Smelter	☐ POTW Sludge	☐ Alcohols	☐ Lubricants	☐ Radiological
☐ Dyes/Inks	☐ Non-ferrous Smelter	☐ Aluminum	☐ Ketones	☐ PCBS	☐ Municipal
☐ Cyanides	☐ Metals:	☐ Distillation Bottoms	☐ Esters	☐ Polynuclear Aromatics	☐ Construction
☐ Phenols			☐ Ethers		☐ Munitions
☐ Halogens	☐ Other	☐ Other	☐ Other	☐ Other	☐ Other
☐ Dioxins	**Specify:**	**Specify:**	**Specify:**	**Specify:**	**Specify:**
☐ Other					
Specify:					

Overall Hazard Evaluation: ☐ High ☐ Medium ■ Low ☐ Unknown (Where tasks have different hazards, evaluate each. Attach additional sheets if necessary)

Justification: CDM personnel will avoid unnecessarily agitating suspect materials and visibly dusty conditions.

Fire/explosion Potential: ☐ High ☐ Medium ■ Low ☐ Unknown

Background Review: ■ Complete ☐ Incomplete Additional information to be collected in this and future investigations.

Known Contaminants	*Highest Observed Concentration (specify units and media)*	*PEL/TLV ppm or mg/m³ (specify)*	*IDLH ppm or mg/m³ (specify)*	*Excursion Limit (≤30 minutes)*	*Symptoms/Effects of Acute Exposure*	*Photoionization Potential*
Asbestos	10 percent (S)	0.1 f/cc (A)	N/A	NA	Assumed to be similar to overexposure of nuisance dust (e.g., eye irritant)	N/A

ACGIH = American Conference of Government Industrial Hygienists
CA = Human carcinogen
CAS = Chemical Abstract Service
IDLH = Immediately Dangerous to Life and Health (NIOSH standard enforced by law)
LEL = Lower Explosive Limit
mg/m^3 = milligrams per cubic meter
NE = Not established
NIOSH = National Institute for Occupational Safety and Health
OSHA = Occupational Safety and Health Administration
PEL = Permissible Exposure Limit (OSHA-established workplace standards enforced by law)
ppm = parts per million
STEL = Short Term Exposure Limit (15 minute TWA)
TLV = Threshold Limit Values (Recommended by ACGIH)
TWA = Time-Weighted Average (Average concentration for a normal 8-hour working day or 40-hour working week)
µg/kg = micrograms per kilogram
µg/ = micrograms per Liter

* = personal air monitoring
** = ambient/perimeter re-occupancy
*** = cutting hole in ceiling - 30 minute excursion

Health and Safety Plan Form	Environmental Protection Agency -- Region 8 --	CDM Federal Programs Corporation

Field Activities Covered under this Plan				*Hazard*
Task Description/specific Technique-Standard Operating Procedures/Site Location(attach additional sheets as necessary)	*Type*	*Primary*	*Contingency*	*Schedule*
1 Attic Inspections	Intrusive	Level C - Modified	Exit Area	Hazard Risk: LOW
	Non-Intrusive			Date: 2003
2 Building Material Inspections	Intrusive	Level C - Modified	Exit Area	Hazard Risk: LOW
	Non-Intrusive			Date: 2003
3 Dust Sampling	Intrusive	Level D- Modified	Level C - Modified	Hazard Risk: LOW
	Non-Intrusive			Date: 2003
4 Soil Sampling for suspected contaminated areas	Intrusive	Level C- Modified	Exit Area	Hazard Risk: LOW
	Non-Intrusive			Date: 2003
5	Intrusive			Hazard Risk:
	Non-Intrusive			Date:
6	Intrusive			Hazard Risk:
	Non-Intrusive			Date:
7	Intrusive			Hazard Risk:
	Non-Intrusive			Date:

Personnel and Responsibilities (Include subcontractors)

Name	Firm/Region	CDM Federal Health Clearance	Responsibilities	Onsite Involvement
Jeff Montera	CDM - Denver	Yes	Project Manager	No
Dave Schroeder	CDM - Chantilly	Yes	Onsite Manager	Task 1 -4
Dee Warren	CDM - Denver	Yes	Task Leader	Task 1 -4

Protective Equipment: Specify by task. Indicate type and/or material as necessary. Use copies of this sheet if needed.

Block A — **Tasks: 1** — **Level: C - Modified** — ■ **Primary** ☐ **Contingency**

Respiratory: ☐ Not Needed
☐ SCBA, Airline:
■ APR: Full or half face
■ Cartridge: P100
☐ Escape Mask:
☐ Other:

Head and Eye: ☐ Not Needed
■ Safety Glasses: with half race respirator
☐ Face Shield:
☐ Goggles:
☐ Hard Hat:
☐ Other:

Boots: ☐ Not Needed
■ Boots: **Leather steel-toed safety boots/shoes**
■ Overboots:
☐ Rubber:

Prot. Clothing: ☐ Not Needed
☐ Encapsulated Suit:
☐ Splash Suit:
☐ Apron
■ Tyvek Coverall: if needed
☐ Cloth Coverall: Cotton as needed
☐ Other: Long pants & long-sleeved shirt

Gloves: ☐ Not Needed
☐ Undergloves:
■ Gloves: Nitrile or surgical/latex.
☐ Overgloves:

☐ Other - specify below

Block B — **Tasks: 1** — **Level: Exit Area** — ☐ **Primary** ■ **Contingency**

Respiratory: ☐ Not Needed
☐ SCBA, Airline:
☐ APR: Full or half face
☐ Cartridge: P100
☐ Escape Mask:
☐ Other:

Head and Eye: ☐ Not Needed
☐ Safety Glasses:
☐ Face Shield:
☐ Goggles:
☐ Hard Hat:
☐ Other:

Boots: ☐ Not Needed
☐ Boots: **Leather steel-toed safety boots/shoes**
☐ Overboots:
☐ Rubber:

Prot. Clothing: ☐ Not Needed
☐ Encapsulated Suit:
☐ Splash Suit:
☐ Apron
☐ Tyvek Coverall:
☐ Cloth Coverall: Cotton as needed
☐ Other: Long pants & long-sleeved shirt

Gloves: ☐ Not Needed
☐ Undergloves:
☐ Gloves: nitrile or surgical/latex
☐ Overgloves:

■ Other - specify below:
Exit area and consult H&S manager regarding PPE upgrade

Block C — **Tasks: 2** — **Level: C - Modified** — ■ **Primary** ☐ **Contingency**

Respiratory: ☐ Not Needed
☐ SCBA, Airline:
■ APR: Full or half face
■ Cartridge: P100
☐ Escape Mask:
☐ Other:

Head and Eye: ☐ Not Needed
■ Safety Glasses: with half face
☐ Face Shield:
☐ Goggles:
☐ Hard Hat:
☐ Other:

Boots: ☐ Not Needed
■ Boots: **Leather steel-toed safety boots/shoes**
■ Overboots:
☐ Rubber:

Prot. Clothing: ☐ Not Needed
☐ Encapsulated Suit:
☐ Splash Suit:
☐ Apron
■ Tyvek Coverall:
☐ Cloth Coverall:
☐ Other:

Gloves: ☐ Not Needed
☐ Undergloves:
■ Gloves: Nitrile or surgical/latex.
☐ Overgloves:

☐ Other - specify below:

Block D — **Tasks: 2** — **Level: Exit Area** — ☐ **Primary** ■ **Contingency**

Respiratory: ☐ Not Needed
☐ SCBA, Airline:
☐ APR:
☐ Cartridge:
☐ Escape Mask:
☐ Other:

Head and Eye: ☐ Not Needed
☐ Safety Glasses:
☐ Face Shield:
☐ Goggles:
☐ Hard Hat:
☐ Other:

Boots: ☐ Not Needed
☐ Boots: **Leather steel-toed safety boots/shoes**
☐ Overboots:
☐ Rubber:

Prot. Clothing: ☐ Not Needed
☐ Encapsulated Suit:
☐ Splash Suit:
☐ Apron
☐ Tyvek Coverall:
☐ Cloth Coverall:
☐ Other:

Gloves: ☐ Not Needed
☐ Undergloves:
☐ Gloves:
☐ Overgloves:

■ Other - specify below:
Exit area and consult H&S manager regarding PPE upgrade

Protective Equipment: Specify by task. Indicate type and/or material as necessary. Use copies of this sheet if needed.

Block A — **Tasks: 3** — **Level: D - Modified** — ■ **Primary** ☐ **Contingency**

Respiratory: ■ Not Needed
☐ SCBA, Airline:
☐APR:
☐Cartridge: P100
☐ Escape Mask:
☐ Other:

Head and Eye: ☐ Not Needed
■ Safety Glasses:
☐ Face Shield:
☐ Goggles:
☐ Hard Hat:
☐ Other:

Boots: ☐ Not Needed
■ Boots: **Leather steel-toed safety boots/shoes**
☐ Overboots:
☐ Rubber:

Prot. Clothing: ■ Not Needed
☐ Encapsulated Suit:
☐ Splash Suit:
☐ Apron
☐ Tyvek Coverall: if needed
☐ Cloth Coverall: Cotton as needed
☐ Other: Long pants & long-sleeved shirt

Gloves: ■ Not Needed
☐ Undergloves:
☐ Gloves: Nitrile or surgical/latex.
☐ Overgloves:

☐ Other - specify below:

Block B — **Tasks: 3** — **Level: C- Modified** — ☐ **Primary** ■ **Contingency**

Respiratory: ☐ Not Needed
☐ SCBA, Airline:
■ APR: Full or half face
■ Cartridge: P100
☐ Escape Mask:
☐ Other:

Head and Eye: ☐ Not Needed
■ Safety Glasses:
☐ Face Shield:
☐ Goggles:
☐ Hard Hat:
☐ Other:

Boots: ☐ Not Needed
■ Boots: **Leather steel-toed safety boots/shoes**
■ Overboots:
☐ Rubber:

Prot. Clothing: ☐ Not Needed
☐ Encapsulated Suit:
☐ Splash Suit:
☐ Apron
■ Tyvek Coverall:
☐ Cloth Coverall: Cotton as needed
☐ Other: Long pants & long-sleeved shirt

Gloves: ☐ Not Needed
☐ Undergloves:
■ Gloves: nitrile or surgical/latex
☐ Overgloves:

☐ Other - specify below:

Block C — **Tasks: 4** — **Level: C- Modified** — ■ **Primary** ☐ **Contingency**

Respiratory: ☐ Not Needed
☐ SCBA, Airline:
■ APR: Full or half face
■ Cartridge:P100
☐ Escape Mask:
☐ Other: PAPA

Head and Eye: ☐ Not Needed
■ Safety Glasses: with half face
☐ Face Shield:
☐ Goggles:
☐Hard Hat:
☐ Other:

Boots: ☐ Not Needed
■ Boots: **Leather steel-toed safety boots/shoes**
☐ Overboots:
☐ Rubber:

Prot. Clothing: ☐ Not Needed
☐ Encapsulated Suit:
☐ Splash Suit:
☐ Apron
■ Tyvek Coverall:
☐ Cloth Coverall:
☐ Other:

Gloves: ☐ Not Needed
☐ Undergloves:
■ Gloves: Nitrile or surgical/latex.
☐ Overgloves:

☐ Other - specify below:

Block D — **Tasks: 4** — **Level: Exit Area** — ☐ **Primary** ■ **Contingency**

Respiratory: ■ Not Needed
☐ SCBA, Airline:
☐ APR: Full or half face
☐ Cartridge:P100
☐ Escape Mask:
☐ Other:

Head and Eye: ■ Not Needed
☐ Safety Glasses:
☐ Face Shield:
☐ Goggles:
☐ Hard Hat:
☐ Other:

Boots: ☐ Not Needed
■ Boots: **Leather steel-toed safety boots/shoes**
☐ Overboots:
☐ Rubber:

Prot. Clothing: ■ Not Needed
☐ Encapsulated Suit:
☐ Splash Suit:
☐ Apron
☐ Tyvek Coverall:
☐ Cloth Coverall:
☐ Other:

Gloves: ■ Not Needed
☐ Undergloves:
☐ Gloves: Nitrile or surgical/latex.
☐ Overgloves:

☐ Other - specify below: **Exit area and consult H&S manager regarding PPE upgrade**

Health and Safety Plan Form	Environmental Protection Agency -- Region 8 --	CDM Federal Programs Corporation

Monitoring Equipment: Specify by task. Indicate type as necessary. Attach additional sheets as necessary.

Instrument	*Task*	*Action Guidelines*	*Comments (Include schedules of use)*
Combustible Gas Indicator	1 - 4	0-10% LEL — No explosion hazard 10-25% LEL — Potential explosion hazard; notify SHSC. **>25% LEL — Explosion hazard; interrupt task/evacuate** 21.0% 0_2 <21.0% 0_2 — Oxygen normal **<19.5% 0_2 — Oxygen deficient; notify SHSC Interrupt task/evacuate**	■ Not Needed Entering tanks, vats, sumps, and other confined spaces is strictly forbidden.
Radiation Survey Meter Type _____	1 - 4	3X Background — Notify SHSO and CDM Federal HSM, establish REZ **>2mR/hr — Interrupt task/evacuate**	■ Not Needed Radiation is not an expected hazard.
Photoionization Detector Type _____ ☐ 11.7 eV ☐ 10.2 eV ☐ 9.8 eV ☐ ___ eV	1 - 4	**Specify:** **Detectable Odor — If odor of any kind is detected, cease work, move to fresh air.**	■ Not Needed If further work is necessary in the area where odors are detected, personnel protection will be evaluated.
Flame Ionization Detector Type _____	1 - 4	**Specify:**	■ Not Needed If further work is necessary in the area where odors are detected, personnel protection will be evaluated.
Detector Tubes/Monitor Type _____ Type _____	1 - 4	**Specify:**	■ Not Needed Toxic gases are not expected to be encountered. Entrance into confined spaces where toxic gases could be concentrated is strictly forbidden.
Respirable Dust Monitor Type _____ Type _____	1 - 4	**Specify:**	■ Not Needed If dusty conditions persist, site will be abandoned and personnel protection reevaluated.
Other **Specify: Visible or nuisance dust and/or unusual vapors (odors)**	1 - 4	**Specify: If team notices unusual odors, heavy dust, or irritation of the eyes or throat, they will exit area and reevaluate personnel protection.**	

Decontamination Procedures

Personalized Decontamination

Wash well before hand to mouth contact is made. A shower will be taken as soon as possible after leaving the field. Workers will remove protective clothing in this order:

(1) wash overboots in soapy water and rinse
(2) remove overboots or booties
(3) remove gloves
(4) wet wipe and remove safety glasses
(5) remove Tyvek or cloth coverall, if used
(6) remove respirator, if used
(7) remove inner gloves
(8) wash hands/face before eating/drinking

☐ Not Needed

Containment and Disposal Method

All disposable PPE will be double-bagged prior to disposal. Decon water to be disposed onsite.

☐ Not Needed

Sampling Equipment Decontamination

See CDM Federal SOP 4-5. All sampling equipment will be thoroughly decontaminated as follows:

(1) wash and scrub with low phosphate detergent
(2) potable tap water rinse
(3) potable tap water rinse
(4) thoroughly rinse with deionized water
(5) air dry
(6) wrap in aluminum foil for transport

☐ Not Needed

Containment and Disposal Method

Decon water to be disposed onsite.

☐ Not Needed

Heavy Equipment Decontamination

See CDM Federal SOP 4-5. All heavy equipment and tool parts that contact subsurface soil are constructed of heavy gauge steel and have no natural or synthetic components that could absorb and retain most soil-borne organic contaminants.

Prior to removal from the work site, potential contaminated soil/groundwater will be scraped or brushed from the exterior surfaces.

The drill rig, augers and any other large equipment in the exclusion zone will be taken to a decon pad and steam cleaned.

■ Not Needed

Containment and Disposal Method

All disposable PPE will be double-bagged prior to disposal.

■ Not Needed

Hazardous Materials Inventory (Investigation-Associated Substances: Attach MSDS)

Preservatives

☐ Hydrochloric Acid (HCl)
☐ Nitric Acid (HNO_3)
☐ Sulfuric Acid (H_2SO_4)
☐ Sodium Hydroxide (NaOH)
☐ Zinc Acetate (ZnOAc)
☐ Ascorbic Acid
☐ Other:
☐ Other:

Decontamination

■ Alconox™
☐ Liquinox™
☐ Acetone
☐ Methanol
☐ Mineral Spirits
☐ Hexane
☐ Isopropanol
☐ Nitric Acid
■ Other: Water

Calibration Gases and Fluids

☐ Isobutylene
☐ Methane
☐ Pentane
☐ Hydrogen
☐ Propane
☐ pH Standard
☐ Conductivity Standard
☐ Other
☐ Other

Health and Safety Plan Form	Environmental Protection Agency -- Region 8 --	CDM Federal Programs Corporation

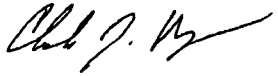
Emergency Contacts	
Water Supply	NA
Site Telephone	1-406-293-8595
EPA Release Report No.	1-800-424-8802
CDM 24-Hour Emergency Chuck Myers	(cell) 1-571-216-7004
Facility Management	NA
Other (Specify) Health & Safety Mgr.	Chuck Myers (home) 1-703-754-0700 SHSO 1-406-293-3567
CHEMTREC Emergency	1-800-424-9300

Emergency Contacts	***Name***	***Phone***
Health and Safety Manager	Chuck Myers, CIH	1-703-968-0900 (office)
Project Manager	Jeff Montera	1-303-295-1237
Site Health & Safety Coor.	Douglas J. Updike	1-816-412-3149
Site Health & Safety Officer	Shawn Oliveira/Noel Anderson	1-406-293-3567
EPA Contact	Jim Christiansen	1-303-312-6748
Environmental Agency		1-800-234-5677
Health Department		1-406-293-3757
Sheriff's Department	Lincoln County	911
State Spill Line		911
Fire Department	.	911
Police Department - Libby		911
State Police	Highway Patrol	1-800-525-5555
Poison Control Center		1-800-525-5042
Occupational Physician	Health Resources	1-800-229-3671

Contingency Plans Summarize below:

Evacuate site if any unexpected hazardous conditions are encountered. If staff observe hazards for which they have not been prepared, they will withdraw from the area and call CDM Federal Health and Safety. CDM Federal personnel will leave the site and upgrade their level of protection if they experience nausea or dizziness. No volatile compounds are expected to be encountered at concentrations dangerous to human health. If any odors are noted, work will cease and personnel protection reevaluated. In the event of medical emergency, contact Hospital, Police, or Sheriff's Department. If respirable dust is noted, additional engineering controls will be implemented. If these controls do not eliminate the exposure, personnel protection will be re-evaluated.

Health and Safety Plan Approvals

Prepared by: Dee Warren	Date: 4/24/03
SHSO Signature:	Date:
HSM Signature: 	Date:
For: Chuck Myers, CIH	

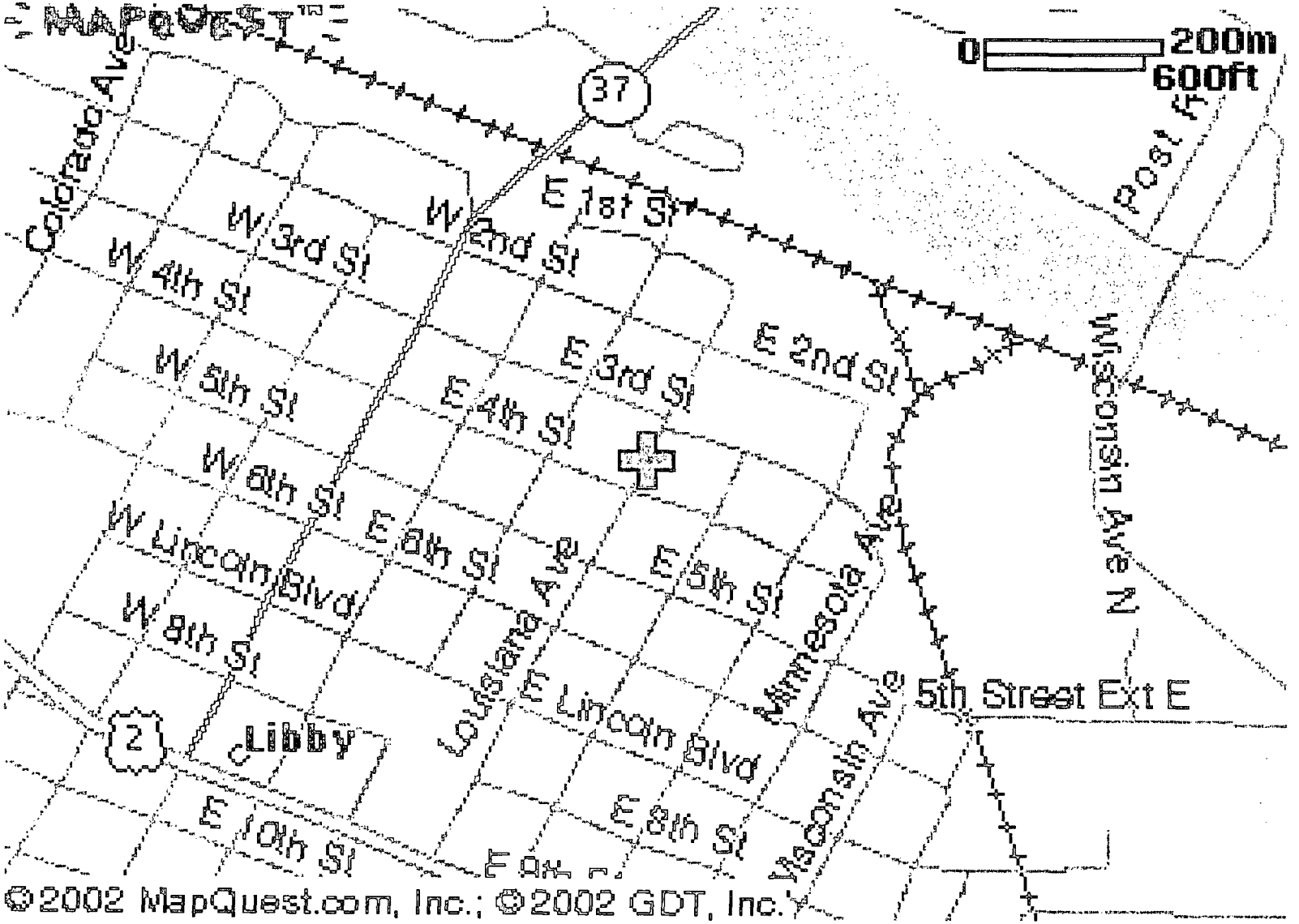
Medical Emergency

Hospital Name: St. John's Lutheran Hospital	406-293-7761
Hospital Address: 350 Louisiana Avenue	
Name of Contact at Hospital: NA	
Name of 24-Hour Ambulance:	911

Route to Hospital (See Figure 1)

Directions to the hospital will vary depending on where you are located in the site area. The hospital is located at the intersection of Louisiana and 4th Avenue.

This Page Reserved for Hospital Route Map: Johns Lutheran Hospital, 350 Louisiana Ave, Libby, MT 59923



Health and Safety Plan Form	Environmental Protection Agency -- Region 8 –	CDM Federal Programs Corporation

The following personnel have read and fully understand the contents of this Health and Safety Plan and further agree to all requirements contained herein.

Site: Libby, Montana, Asbestos Removal	Project No.:		
Name and Responsibility	**Affiliation**	**Date**	**Signature**
Jeff Montera	CDM - Denver		
Dave Schroeder	CDM - Chantilly		

Appendix C

CDM Technical Standard Operating Procedures and Site-Specific Guidance Documents

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Project-Specific Modification

SOP No.: 1-2

SOP Title: Sample Custody

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: [signature] Date: 5/7/03

Technical Reviewer: [signature] Date: 5/7/03

QA Reviewer: [signature] Date: 5/12/03

EPA Approval: [signature] Date: 5/19/03

NOTE: Each media (soil/dust) must be submitted on separate COC forms.

The sample coordinator assistant will use the FSDS to complete an electronic chain of custody (eCOC). The sample coordinator will check the data entered to create the eCOC against the FSDSs. Three paper copies of the eCOC will then be generated. One copy will be filed in the CDM Libby office and the other two will be sent with the samples. The sample coordinator will then check the eCOC versus the sample containers and sample shipment. The sample coordinator will be responsible for shipment of samples. If any errors are found on an eCOC after shipment, the paper copy of the COC will be corrected by the sample coordinator with a single strikeout initial and date. The corrected copy will be faxed to Volpe and the laboratory. The fax to Volpe will be used to update the Libby project database.

Reason for and duration of modification: Sample custody procedures for the Libby asbestos project vary slightly from SOP 1-2. These modifications are necessary for the entire duration of the project.

Project-Specific Modification

Via: Hand delivery or shipped. Hand delivery refers to samples delivered by hand to the onsite laboratory; shipped refers to samples sent to the laboratory by delivery service (i.e., Federal Express). To be completed by the sample coordinator.

Project: All samples collected in accordance with this sampling and analysis plan (SAP) are part of the CSS. Circle CSS. To be completed by the field team.

Sample Placed in Cooler/Bag: Refers to visual confirmation of the sample in the shipping container. To be completed by the sample coordinator.

Index ID: Unique index identification number used to identify sample, in the form CSS-#####. To be completed by the field team.

Sample Date: The date each sample was collected, in the form MM/DD/YY. To be completed by the field team.

Sample Time: The time each sample was collected, in military time. To be completed by the field team.

Sample Matrix: The matrix of each sample collected, specific to the CSS; S = soil and W = water. To be completed by the field team.

Sample Type: Sample type of each sample collected; G = grab, C = composite. To be completed by the field team.

Volume: Specific to air and dust samples. Does not pertain to the CSS. "NA" should be placed in this field. To be completed by the field team.

Analysis Request: Analysis of each sample collected. All soil samples will be analyzed by IR. IR will be written in the analysis request portion of the COC form by the field team. The sample coordinator and/or laboratory coordinator may request SEM analysis based on Table 5-2 of the SAP. The sample coordinator and/or laboratory coordinator will designate IR for the appropriate samples.

Comments: Any pertinent information regarding the sample (i.e., vermiculite visible) will be entered by either the field team or the sample coordinator.

Sample Received by Lab: To be checked by the sample custodian at the laboratory upon receipt of the samples to confirm presence of each sample on the COC record.

Project-Specific Modification

Total Number of Samples: Total number of samples on the COC form. To be completed by the field team.

Additional Comments: Any additional comments that relate to samples on the COC form (i.e., turn around times). To be completed by the field team or sample coordinator.

Relinquished by: (1) Signed by field team member that relinquishes samples to sample coordinator and company of person relinquishing samples to sample coordinator (i.e., CDM). Date of relinquish shall be in the form MM/DD/YY and time shall be in military time. (2) Additional relinquished by lines to be completed following standard sample custody procedures.

Received by: (1) Signed by sample coordinator that receives samples from the sampling team and company of person accepting samples from the field teams (i.e., CDM). Date and time of acceptance should be the same as date and time of relinquish. (2) Additional received by lines to be completed following standard sample custody procedures.

Sample Condition upon Receipt: Will reflect the condition of samples at the relinquish time (i.e., accept ok or not acceptable with an explanation). To be completed by the person receiving samples.

Page ___ of ___: Sequential page number of the entire COC set sent to the laboratory. To be completed by the sample coordinator.

SAMPLE CUSTODY

SOP 1-2
Revision: 3
Date October 12, 2001

Prepared: David O. Johnson
Technical Review: Jackie Mosher
QA Review: Doug Updike
Approved: _____ 10/12/01
Signature/Date
Issued: _____ 10/12/01
Signature/Date

1.0 OBJECTIVE

Due to the evidentiary nature of samples collected during environmental investigations, possession must be traceable from the time the samples are collected until their derived data are introduced as evidence in legal proceedings. To maintain and document sample possession, sample custody procedures are followed. All paperwork associated with the sample custody procedures will be retained in CDM Federal Programs Corporation (CDM Federal) files unless the client requests that it be transferred to them for use in legal proceedings or at the completion of the contract.

Note: Sample custody documentation requirements vary with the specific EPA region or client. This SOP is intended to present basic sample custody requirements, along with common options. Specific sample custody requirements should be presented in the project-specific quality assurance (QA) project plan or project-specific modification or clarification form (See Section U-1).

2.0 BACKGROUND

2.1 Definitions

Sample – A sample is material to be analyzed that is contained in single or multiple containers representing a unique sample identification number.

Sample Custody – A sample is under custody if:

1. It is in your possession.
2. It is in your view, after being in your possession.
3. It was in your possession and you locked it up.
4. It is in a designated secure area.

Chain-of-Custody Record – A chain-of-custody record is a form used to document the transfer of custody of samples from one individual to another.

Custody Seal - A custody seal is a tape-like seal that is part of the chain-of-custody process and is used to detect tampering with samples after they have been packed for shipping.

Sample Label – A sample label is an adhesive label placed on sample containers to designate a sample identification number and other sampling information.

Sample Tag – A sample tag is attached with string to a sample container to designate a sample identification number and other sampling information. Tags may be used when it is difficult to physically place adhesive labels on the container (e.g., in the case of small air sampling tubes).

3.0 RESPONSIBILITIES

Sampler – The sampler is personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

Field Team Leader (FTL) – The FTL is responsible for ensuring that strict chain-of-custody procedures are maintained during all sampling events. The FTL is also responsible for coordinating with the subcontractor laboratory to ensure that adequate information is recorded on custody records. The FTL determines whether proper custody procedures were followed during the fieldwork and decides if additional samples are required.

Field Sample Custodian – The field sample custodian, when designated by the FTL, is responsible for accepting custody of samples from the sampler(s) and properly packing and shipping the samples to the laboratory assigned to do the analyses. A field sample custodian is typically designated only for large and complex field efforts.

4.0 REQUIRED SUPPLIES

- Chain-of-custody records (applicable client or CDM Federal forms)
- Custody seals
- Sample labels or tags
- Clear tape

5.0 PROCEDURES

5.1 Chain-of-Custody Record

This procedure establishes a method for maintaining custody of samples through use of a chain-of-custody record. This procedure will be followed for all samples collected or split samples accepted.

Field Custody

1. Collect only the number of samples needed to represent the media being sampled. To the extent possible, determine the quantity and types of samples and sample locations prior to the actual fieldwork. As few people as possible should handle samples.

2. Complete sample labels or tags for each sample, using waterproof ink.

Transfer of Custody and Shipment

1. Complete a chain-of-custody record for all samples (see Figure 1 for an example of a chain-of-custody record. Similar forms may be used when requested by the client). When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents sample custody transfer from the sampler, often through another person, to the sample custodian in the appropriate laboratory.

   - The date/time will be the same for both signatures when custody is transferred directly to another person. When samples are shipped via common carrier (e.g., Federal Express), the date/time will not be the same for both signatures. Common carriers are not required to sign the chain-of-custody record.

   - In all cases, it must be readily apparent that the person who received custody is the same person who relinquished custody to the next custodian.

   - If samples are left unattended or a person refuses to sign, this must be documented and explained on the chain-of-custody record.

NOTE: If a field sample custodian has been designated, he/she may initiate the chain-of-custody record, sign and date as the relinquisher. The individual sampler(s) must sign in the appropriate block, but does (do) not need to sign and date as a relinquisher (refer to Figure 1).

2. Package samples properly for shipment and dispatch to the appropriate laboratory for analysis. Each shipment must be accompanied with a separate chain-of-custody record.

3. Include a chain-of-custody record identifying its content in all shipments (refer to Figure 1). The original record will accompany the shipment, and the copies will be retained by the FTL and, if applicable, distributed to the appropriate sample coordinators. Freight bills will also be retained by the FTL as part of the permanent documentation.

Figure 1
EXAMPLE CDM Federal Chain-of-Custody Record

CDM Federal Programs Corporation
A subsidiary of Camp Dresser & McKee Inc.

125 Maiden Lane, 5th Floor
New York, NY 10038
(212) 785-9123
Fax: (212) 785-6114

CHAIN OF CUSTODY RECORD

PROJECT ID.	FIELD TEAM LEADER	LABORATORY AND ADDRESS	DATE SHIPPED
PROJECT NAME/LOCATION		LAB CONTRACT:	AIRBILL NO.

MEDIA TYPE
1. Surface Water
2. Groundwater
3. Leachate
4. Field QC
5. Soil/Sediment
6. Oil
7. Waste
8. Other _____

PRESERVATIVES
1. HCl, pH <2
2. HNO3, pH <2
3. NaOH, pH >12
4. H2SO4, pH <2
5. Zinc Acetate, pH >9
6. Ice Only
7. Not Preserved
8. Other _____

SAMPLE TYPE
G = Grab
C = Composite

SAMPLE LOCATION NO.	LABORATORY SAMPLE NUMBER	PRESER-VATIVES ADDED	MEDIA TYPE	SAMPLE TYPE	19__ DATE	TIME SAMPLED	ANALYSES (List no. of containers submitted)								REMARKS (Note if MS/MSD)
1.															
2.															
3.															
4.															
5.															
6.															
7.															
8.															
9.															
10.															

SAMPLER SIGNATURES:

RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME	RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME
(SIGN)		(SIGN)		(SIGN)		(SIGN)	
RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME	RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME
(SIGN)		(SIGN)		(SIGN)		(SIGN)	

COMMENTS:

DISTRIBUTION: White and yellow copies accompany sample shipment to laboratory; yellow copy retained by laboratory. Pink copy retained by samplers. 1/98

NOTE: If requested by the client, different chain-of-custody records may be used. Copies of the template for this record may be obtained from the Fairfax Graphics Department.

SAMPLE CUSTODY

Procedure for Completing CDM Federal Example Chain-of-Custody Record (Refer to Figure 1.)

The following procedure is to be used to fill out the CDM Federal chain-of-custody record. The record is provided herein as an example chain-of-custody record. If another type of custody record (i.e., provided by the EPA contract laboratory program or a subcontract laboratory) is used to track the custody of samples, the custody record should be filled out in its entirety.

1. Record project number.
2. Record FTL for the project (if a field sample custodian has been designated, also record this name in the "Remarks" box).
3. Record the name and address of the laboratory to which samples are being shipped.
4. Enter the project name/location or code number.
5. Record overnight courier's airbill number.
6. Record sample location number.
7. Record sample number.
8. Note preservatives type and reference number.
9. Note media type (matrix) and reference number.
10. Note sample type.
11. Enter date of sample collection.
12. Enter time of sample collection in military time.
13. When required by the client, enter the names or initials of the samplers next to the sample location number of the sample they collected.
14. List parameters for analysis and the number of containers submitted for each analysis.
15. Enter MS/MSD (matrix spike/matrix spike duplicate) if sample is for laboratory quality control or other remarks (e.g. sample depth).
16. Sign the chain-of-custody record(s) in the space provided. All samplers must sign each record.
17. If sample tags are used, record the sample tag number in the "Remarks" column.
18. Record date shipped.
19. The originator checks information entered in Items 1 through 16 and then signs the top left "Relinquished by" box, prints his/her name, and enters the current date and time (military).

20. Send the top two copies (usually white and yellow) with the samples to the laboratory; retain the third copy (usually pink) for the project files. Retain additional copies for the project file or distribute as required to the appropriate sample coordinators.

21. The laboratory sample custodian receiving the sample shipment checks the sample label information against the chain-of-custody record. Sample condition is checked and anything unusual is noted under "Remarks" on the chain-of-custody record. The laboratory custodian receiving custody signs in the adjacent "Received by" box and keeps the copy. The white copy is returned to CDM Federal.

5.2 Sample Labels and Tags

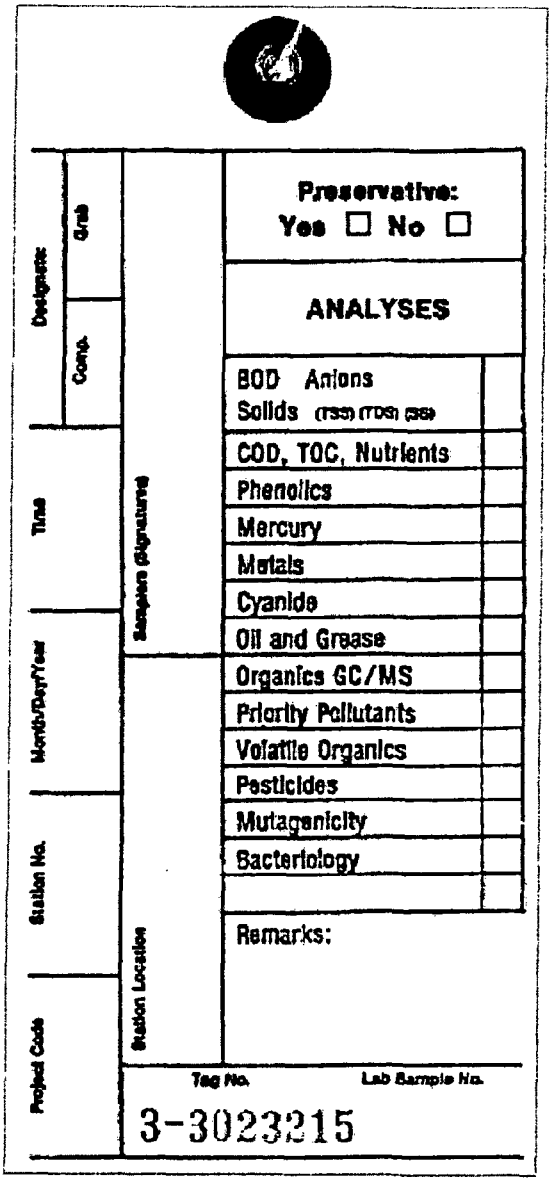
Unless the client directs otherwise, sample labels or tags will be used for all samples collected or accepted for CDM Federal projects.

1. Complete one label or tag with the information required by the client for each sample container collected. A typical label or tag would be completed as follows (see Figure 2 for example of sample tag; labels are completed with the equivalent information):
   - Record the project code (i.e., project or task number).
   - Enter the station number (sample number) if applicable.
   - Record the date to indicate the month, day, and year of sample collection.
   - Enter the time (military) of sample collection.
   - Place a check to indicate composite or grab sample.
   - Record the station (sample) location.
   - Sign in the space provided.
   - Place a check next to "yes" or "no" to indicate if a preservative was added.
   - Place a check under "Analyses" next to the parameters for which the sample is to be analyzed. If the desired analysis is not listed, write it in the empty slot. Note: Do not write in the box for "laboratory sample number."
   - Place or write additional relevant information under "Remarks".

2. Place adhesive labels directly on the sample containers. Place clear tape over the label to protect from moisture.

3. Securely attach sample tags to the sample bottle. On 80 oz. amber bottles, the tag string may be looped through the ring style handle and tied. On all other containers, it is recommended that the string be looped around the neck of the bottle, then twisted and re-looped around the neck until the slack in the string is removed.

Figure 2
EXAMPLE Sample Tag



NOTE: Equivalent sample labels or tags may be used.

5.3 Custody Seals

Custody seals must be placed on the shipping containers (e.g., picnic cooler) prior to shipment. The seal should be signed and dated by a field team member.

Custody seals may also be placed on individual sample bottles. Check with the client or refer to EPA regional guidelines for direction.

5.4 Sample Shipping

The CDM Federal standard operating procedure listed below defines the requirements for packaging and shipping environmental samples.

- CDM Federal SOP 2-1, Packaging and Shipping of Environmental Samples

6.0 RESTRICTIONS/LIMITATIONS

Check with the EPA region or client for specific guidelines. If no specific guidelines are identified, this procedure should be followed.

For EPA Contract Laboratory Program (CLP) sampling events, combined chain-of-custody/traffic report forms or other EPA-specific records may be used. Refer to regional guidelines for completing these forms.

The EPA FORMS II Lite™ software may be used to customize sample labels and custody records when directed by the client or the CDM Federal project manager.

7.0 REFERENCES

U.S. Environmental Protection Agency, *EPA Guidance for Quality Assurance Project Plans*, EPA QA/G-5, EPA/600/R-98/018, February 1998, Section B3.

U.S. Environmental Protection Agency, *National Enforcement Investigations Center, Multi-Media Investigation Manual*, EPA-330/9-89-003-R, Revised March 1992, p.85.

U.S. Environmental Protection Agency, *Contract Laboratory Program (CLP), Guidance for Field Samplers*, EPA-540-R-00-003, Draft Final, June 2001, Section 3.2.

U.S. Environmental Protection Agency, *FORMS II Lite™ User's Guide*, March 2001

U.S. Environmental Protection Agency, Region IV, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, May 1996, Section 3.3.

U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plan*, EM 200-1-3, February 2001, Appendix F.

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Project-Specific Modification

SOP No.: 2-1

SOP Title: Packaging and Shipping of Environmental Samples

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Procedures for shipping environmental samples for the Libby asbestos project vary slightly from CDM Technical SOP 2-1. These modifications are necessary for the entire duration of the project.

Samples collected during this investigation will be packaged and shipped in accordance with CDM Technical SOP 2-1, with the following modifications:

Section 1.4, Required Equipment - Vermiculite (or other absorbent material), bubble wrap, or ice will not be used for packaging or shipping samples.

Section 1.5, Procedures - No vermiculite or other absorbent material will be used to pack the samples. No ice will be used.

PACKAGING AND SHIPPING OF ENVIRONMENTAL SAMPLES

SOP: 2-1
Revision: 1
Date: June 20, 2001
Page 1 of 27

Prepared: Krista Lippoldt Technical Review: Brian Jenks

QA Review: David O. Johnson Approved: _____ Signature/Date

Issued: _____ Signature/Date

1.0 PACKAGING AND SHIPPING OF ALL SAMPLES – This standard operating procedure (SOP) applies to the packaging and shipping of all environmental samples. If the sample is preserved or radioactive, the following sections may also be applicable.

Section 2.0 – Packaging and Shipping of Samples Preserved with Hexane
Section 3.0 – Packaging and Shipping of Samples Preserved with Sodium Hydroxide
Section 4.0 – Packaging and Shipping of Samples Preserved with Hydrochloric Acid
Section 5.0 – Packaging and Shipping of Samples Preserved with Nitric Acid
Section 6.0 – Packaging and Shipping of Samples Preserved with Sulfuric Acid
Section 7.0 – Packaging and Shipping of Limited Quantity Radioactive Samples

1.1 OBJECTIVE

The objective of this SOP is to outline the requirements for the packaging and shipment of environmental samples.

1.2 BACKGROUND

1.2.1 Definitions

Environmental Sample - An environmental sample is any sample that has less than reportable quantities for any hazardous constituents according to Department of Transportation (DOT) regulations promulgated in 49 CFR - Part 172.

Custody Seal – A custody seal is a narrow adhesive-backed seal that is applied to individual sample containers and/or the sample shipping container (i.e. cooler) before offsite shipment. Custody seals are used as a protective mechanism to ensure that sample integrity is not compromised during transportation from the field to the analytical laboratory.

Secondary Containment – A secondary containment is the container that the sample is shipped in (i.e., plastic overpackaging if liquid sample is collected in glass).

Exempted Quantity – Exempted quantity is the amount of hazardous material that does not fall under DOT/IATA/ICAO regulations. This exemption is very difficult to meet; most shipments will be made under limited quantity.

Limited Quantity – Limited quantity is the maximum amount of a hazardous material for which there is a specific labeling or packaging exception.

Performance Testing – Performance testing is the required testing of outer packaging. These tests include the drop and stacking test.

Qualified Shipper – A qualified shipper is a person who has been adequately trained to perform the functions of shipping hazardous materials.

1.2.2 Discussion

Proper packaging and shipping is necessary to ensure the protection of the integrity of environmental samples shipped for analysis.

1.2.3 Associated Procedure

- CDM Federal SOP 1-2, Sample Custody

1.3 RESPONSIBILITIES

Field Team Leader (FTL) - The field team leader is responsible for ensuring that packaging and sampling procedures are conducted in accordance with this SOP. The field team leader is also responsible for ensuring that CDM Federal properly coordinates laboratory analysis of samples.

1.4 REQUIRED EQUIPMENT

- Coolers with return address of CDM Federal office
- Heavy-duty plastic garbage bags
- Plastic Ziploc®-type bags, small and large
- Clear tape
- Fiber tape – nylon reinforced strapping tape
- Duct tape
- Vermiculite (or equivalent)*
- Bubble wrap (optional)
- Ice
- Custody seals
- Completed chain-of-custody record or CLP custody records, if applicable
- Completed bill of lading
- "This End Up" and directional arrow labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

1.5 PROCEDURES

The following steps must be followed when packing sample bottles and jars for shipment:

1. Verify the samples undergoing shipment meet the definition of "Environmental Sample" and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with the appropriate health and safety coordinator or the health and safety manager should be observed.

2. Select a sturdy cooler in good repair. Secure and tape the drain plug with fiber or duct tape. Line the cooler with a large heavy-duty plastic garbage bag.

3. Be sure the caps on all bottles are tight (will not leak); check to see that labels and chain-of-custody records are completed properly (SOP 1-2, Sample Custody).

4. Place all bottles in separate and appropriately sized plastic zip-top bags and close the bags. Up to three VOA vials may be packed in one bag. Bottles may be wrapped in bubble wrap. Optionally, place three to six VOA vials in a quart metal can and then fill the can with vermiculite or equivalent. Note: Trip blanks must be included in coolers containing VOA samples.

5. Place 2 to 4 inches of vermiculite (or equivalent) into a cooler that has been lined with a garbage bag, and then place the bottles and cans in the bag with sufficient space to allow for the addition of more packing material between the bottles and cans. It is preferable to place glass sample bottles and jars into the cooler vertically. Due to the strength properties of a glass container, there is much less chance for breakage when the container is packed vertically rather than horizontally.

6. Put ice in large plastic zip-top bags (double bagging the zip-tops is preferred) and properly seal. Place the ice bags on top of and/or between the samples. Several bags of ice are required (dependant on outdoor temperature, staging time, etc.) to maintain the cooler temperature at approximately 4° centigrade. Fill all remaining space between the bottles or cans with packing material. Securely fasten the top of the large garbage bag with fiber or duct tape.

7. Place the completed chain-of-custody record or the CLP traffic report form (if applicable) for the laboratory into a plastic zip-top bag, seal the bag, tape the bag to the inner side of the cooler lid and close the cooler.

8. The cooler lid shall be secured with nylon reinforced strapping tape by wrapping each end of the cooler a minimum of two times. Attach a completed chain-of-custody seal across the hinges of the cooler on opposite sides. The custody seals should be affixed to the cooler with half of the seal on the strapping tape so that the cooler cannot be opened without breaking the seal. Complete two more wraps around with fiber tape and place clear tape over the custody seals.

9. The shipping container lid must be marked "THIS END UP" and arrow labels that indicate the proper upward position of the container should be affixed to the cooler. A label containing the name and address of the shipper (CDM Federal) shall be placed on the outside of the container. Labels used in the shipment of hazardous materials (such as Cargo Only Air Craft, Flammable Solids, etc.) are not permitted on the outside of containers used to transport environmental samples and shall not be used. The name and address of the laboratory shall be placed on the container, or when shipping by common courier, the bill of lading shall be completed and attached to the lid of the shipping container.

1.6 RESTRICTIONS/LIMITATIONS

The holding times for the samples packed for shipment must not be exceeded. It is recommended that samples be packed in time to be shipped nightly for overnight delivery. Use caution when shipping samples for weekend delivery; make arrangements with the laboratory before sending samples.

2.0 PACKAGING AND SHIPPING OF SAMPLES PRESERVED WITH HEXANE

2.1 OBJECTIVE

This section provides guidance for the shipment of soil and water environmental samples regulated under the DOT Hazardous Materials Regulations and the IATA/ICAO Dangerous Goods Regulations for shipment by air and applies only to domestic shipments.

2.2 BACKGROUND

2.2.1 Definitions

Section 1.2.1 defines the terms relevant to this section.

2.2.2 Transportation

This section was prepared for the shipment of hexane-preserved samples.

2.2.3 Containers

- 40 ml glass VOA vials (up to 1L per outer package)

2.3 RESPONSIBILITY

It is the responsibility of the qualified shipper to ensure that each shipment contains no more than the maximum of 24 VOA vials for a total liquid volume of 1 liter and that the shipment is packaged according to IATA/ICAO packaging instruction Y305 for limited quantities of hexane.

REQUIRED EQUIPMENT

- Outer packaging (for limited quantities) insulated cooler that has passed the performance test
- Garbage bags
- Clear tape
- Duct tape
- Strapping tape (optional)
- Ziploc®-type bags, small and large
- Vermiculite (or equivalent)*
- Bubble wrap
- Ice
- Chain-of-custody seals
- Chain-of-custody form
- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 3 flammable liquid labels
- Orientation labels
- Consignor/consignee labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

2.5 PACKAGING

The following steps are to be followed when packaging limited quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials

- Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody)

- Wrap each container (40 ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble wrapped container into a 2.7 mil Ziploc®-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (Maximum of 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a Ziploc®-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  HEXANES MIXTURE
  UN1208
  LTD. QTY.

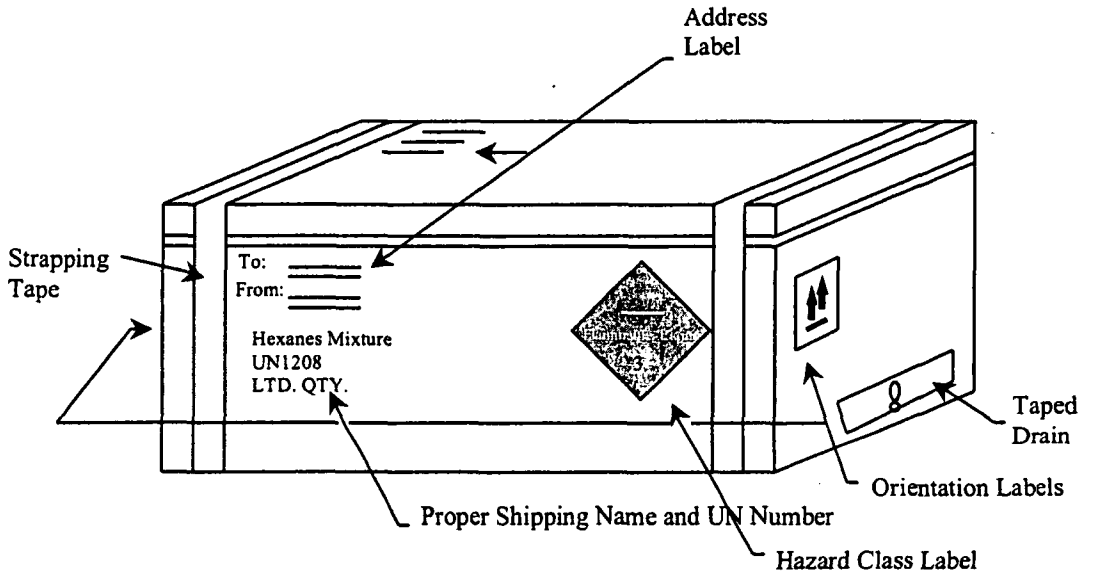
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Flammable Liquid label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

NOTE: No marking or labeling can be obscured by strapping or duct tape.

NOTE: The inner packaging of dangerous goods may be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure the exterior surfaces do not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

Figure 1 Example of Cooler Label/Marking Locations



3.0 PACKAGING AND SHIPPING OF SAMPLES PRESERVED WITH SODIUM HYDROXIDE

3.1 OBJECTIVE

This section provides guidance for the shipment of soil and water environmental samples regulated under the DOT Hazardous Materials Regulations and the IATA/ICAO Dangerous Goods Regulations for shipment by air and applies only to domestic shipments.

3.2 BACKGROUND

3.2.1 Definitions

Section 1.2.1 defines the terms relevant to this section.

3.2.2 Transportation

This section was prepared for the shipment of sodium hydroxide (NaOH) preserved samples.

3.2.3 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Exempted Quantities of Preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
NaOH	30%	>12	0.08%		.25	0.5	1	2

5 drops = 1 ml

3.3 RESPONSIBILITY

It is the responsibility of the qualified shipper to determine the amount of preservative in each sample so that accurate determination of quantities can be made.

REQUIRED EQUIPMENT

- Outer packaging (for limited quantities) insulated cooler that has passed the performance test.
- Garbage bags
- Clear tape
- Duct tape
- Strapping tape (optional)
- Ziploc®-type bags, small and large
- Vermiculite (or equivalent)*
- Bubble wrap (optional)
- Ice
- Custody seals
- Chain-of-custody form

- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

3.5 PACKAGING

Samples containing NaOH as a preservative that exceed the exempted concentration of 0.08 percent (2 ml of a 30 percent per liter) will be shipped as a limited quantity per packing instruction Y809 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble wrapped container into a 2.7 mil Ziploc®-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited quantity shipment of dangerous goods.

- Secure the chain-of-custody form (placed inside a Ziploc®-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

SODIUM HYDROXIDE SOLUTION
UN1824
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

  NOTE: Samples meeting the exemption concentration of 0.08 percent NaOH by weight will be shipped as non-regulated or non-hazardous.

  NOTE: No marking or labeling can be obscured by strapping or duct tape.

  NOTE: The inner packaging of dangerous goods may be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure the exterior surfaces do not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

4.0 PACKAGING AND SHIPPING OF SAMPLES PRESERVED WITH HYDROCHLORIC ACID

4.1 OBJECTIVE

This section provides guidance for the shipment of soil and water environmental samples regulated under the DOT Hazardous Materials Regulations and the IATA/ICAO Dangerous Goods Regulations for shipment by air and applies only to domestic shipments.

4.2 BACKGROUND

4.2.1 *Definitions*

Section 1.2.1 defines the terms relevant to this section.

4.2.2 Transportation

This section was prepared for the shipment of hydrochloric acid (HCl) preserved samples.

4.2.3 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Exempted quantities of preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
HCl	2N	<2	0.04%	.2	.5	1		

5 drops = 1 ml

4.3 RESPONSIBILITY

It is the responsibility of the qualified shipper to determine the amount of preservative in each sample so that accurate determination of quantities can be made.

4.4 REQUIRED EQUIPMENT

- Outer packaging (for limited quantities) insulated cooler that has passed the performance test.
- Garbage bags
- Clear tape

- Duct tape
- Strapping tape (optional)
- Ziploc®-type bags, small and large
- Vermiculite (or equivalent)*
- Bubble wrap
- Ice
- Custody seals
- Chain-of-custody form
- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

4.5 PACKAGING

The following steps are to be followed when packaging limited quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody)
- Wrap each container (40 ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble wrapped container into a 2.7 mil Ziploc®-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (Maximum of 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.

- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a Ziploc®-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

HYDROCHLORIC ACID SOLUTION
UN1789
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

NOTE: Samples meeting the exemption concentration of 0.04 percent HCl by weight will be shipped as non-regulated or non-hazardous.

NOTE: No marking or labeling can be obscured by strapping or duct tape.

NOTE: The inner packaging of dangerous goods may be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure the exterior surfaces do not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.

- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

5.0 PACKAGING AND SHIPPING OF SAMPLES PRESERVED WITH NITRIC ACID

5.1 OBJECTIVE

This section provides guidance for the shipment of soil and water environmental samples regulated under the DOT Hazardous Materials Regulations and the IATA/ICAO Dangerous Goods Regulations for shipment by air and applies only to domestic shipments.

5.2 BACKGROUND

5.2.1 Definitions

Section 1.2.1 defines the terms relevant to this section.

5.2.2 Transportation

This section was prepared for the shipment of nitric acid (HNO_3) preserved samples.

5.2.3 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Exempted quantities of preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
HNO_3	6N	<2	0.15%		2	4	5	8

5 drops = 1 ml

5.3 RESPONSIBILITY

It is the responsibility of the qualified shipper to determine the amount of preservative in each sample so that accurate determination of quantities can be made.

5.4 REQUIRED EQUIPMENT

- Outer packaging (for limited quantities) insulated cooler that has passed the performance test.
- Garbage bags
- Clear tape
- Duct tape
- Strapping tape (optional)
- Ziploc®-type bags, small and large
- Vermiculite (or equivalent)*
- Bubble wrap (optional)
- Ice
- Custody seals
- Chain-of-custody form
- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

5.5 PACKAGING

Samples containing HNO_3 as a preservative that exceed the exempted concentration of 0.15% HNO_3 will be shipped as a limited quantity per packing instruction Y807 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody)

- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble wrapped container into a 2.7 mil Ziploc®-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a Ziploc®-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

NITRIC ACID SOLUTION (with less then 20%)
UN2031
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

NOTE: Samples meeting the exemption concentration of 0.15 percent HNO_3 by weight will be shipped as non-regulated or non-hazardous.

NOTE: No marking or labeling can be obscured by strapping or duct tape.

NOTE: The inner packaging of dangerous goods may be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure the exterior surfaces do not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

6.0 PACKAGING AND SHIPPING OF SAMPLES PRESERVED WITH SULFURIC ACID

6.1 OBJECTIVE

This section provides guidance for the shipment of soil and water environmental samples regulated under the DOT Hazardous Materials Regulations and the IATA/ICAO Dangerous Goods Regulations for shipment by air and applies only to domestic shipments.

6.2 BACKGROUND

6.2.1 Definitions

Section 1.2.1 defines the terms relevant to this section.

6.2.2 Transportation

This section was prepared for the shipment of sulfuric acid (H_2SO_4) preserved samples.

6.2.3 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Exempted quantities of preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
H_2SO_4	37N	<2	0.35%	.1	.25	0.5	1	2

5 drops = 1 ml

6.3 RESPONSIBILITY

It is the responsibility of the qualified shipper to determine the amount of preservative in each sample so that accurate determination of quantities can be made.

6.4 REQUIRED EQUIPMENT

- Outer packaging (for limited quantities) insulated cooler that has passed the performance test.
- Garbage bags
- Clear tape
- Duct tape
- Strapping tape (optional)
- Ziploc®-type bags, small and large
- Vermiculite (or equivalent)*
- Bubble wrap
- Ice
- Custody seals
- Chain-of-custody form
- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

6.5 PACKAGING

Samples containing H_2SO_4 as a preservative that exceed the exempted concentration of 0.35 percent will be shipped as a limited quantity per packing instruction Y809 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection

- Sample location
- Sample identification number
- Collector's initials
- Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody)

- Wrap each glass container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble wrapped container into a 2.7 mil Ziploc®-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a Ziploc®-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

SULFURIC ACID SOLUTION
UN2796
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

NOTE: Samples meeting the exemption concentration of 0.35 percent H_2SO_4 by weight will be shipped as non-regulated or non-hazardous.

NOTE: No marking or labeling can be obscured by strapping or duct tape.

NOTE: The inner packaging of dangerous goods may be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure the exterior surfaces do not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

7.0 PACKAGING AND SHIPPING OF LIMITED QUANTITY RADIOACTIVE SAMPLES

7.1 OBJECTIVE

This section provides guidance for the shipment of soil and water environmental samples regulated under the DOT Hazardous Materials Regulations and the IATA/ICAO Dangerous Goods Regulations for shipment by air and applies only to domestic shipments.

7.2 BACKGROUND

7.2.1 Definitions

Section 1.2.1 defines the terms relevant to this section.

7.2.2 Transportation

This section was prepared for the shipment of environmental samples containing radioactive materials in limited quantities.

7.2.3 Containers

The inner packaging containers that may be used for these shipments include:

- Any size sample container

7.3 DESCRIPTION/RESPONSIBILITIES

- The qualified shipper will ship all samples that meet the Class 7 definition of radioactive materials and meet the activity requirements specified in Table 7 of 49 CFR 173.425, as Radioactive Materials in Limited Quantity. The qualified shipper will verify that all packages and their contents meet the requirements of 49 CFR 173.421, "Limited Quantities of Radioactive Materials."
- The packaging used for shipping will meet the general requirements for packaging and packages specified in 49 CFR 173.24 and the general design requirements provided in 173.410. These standards state that a package must be capable of withstanding the effects of any acceleration, vibration, or vibration resonance that may arise under normal condition of transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the package as a whole and without loosening or unintentionally releasing the nuts, bolts, or other securing devices even after repeated use.
- If the shipment is from a Department of Energy (DOE) facility, radiological screenings will be completed on all samples taken. The qualified shipper will review the results of each screening (alpha, beta, and gamma speciation). Samples will not be shipped offsite until the radiological screening has been performed.
- The total activity for each package will not exceed the relevant limits listed in Table 7 of 49 CFR 173.425. The A_2 value of the material will be calculated based on all radionuclides found during previous investigations (if any) in the area from which the samples are derived. The A_2 values to be used will be the most restrictive of all potential radionuclides as listed in 49 CFR 173.435.
- The radiation level at any point on the external surface of the package bearing the sample(s) will not exceed 0.005 mSv/hour (0.5 mrem/hour). These will be verified by dose and activity monitoring prior to shipment of the package.
- The removable radioactive surface contamination on the external surface of the package will not exceed the limits specified in 49 CFR 173.443(a). CDM Federal will use the DOE-established free release criteria for removable surface contamination of less than 20 dpm/100 cm^2 (alpha) and 1000 dpm/100 cm^2 (beta/gamma). It should be noted that these values are more conservative than the DOT requirements for removable surface contamination.
- The qualified shipper will verify that the outside of the inner packaging is marked "Radioactive".
- The qualified shipper will verify that the excepted packages prepared for shipment under the provisions of 49 CFR 173.421 have a notice enclosed, or shown on the outside of the package, that reads, "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910".

7.4 REQUIRED EQUIPMENT

- Cooler or other acceptable outer packaging
- Garbage bags
- Clear tape
- Duct tape
- Strapping tape (optional)
- Ziploc®-type bags, small and large
- Vermiculite (for water samples) or equivalent*
- Bubble wrap (optional)
- Ice (if necessary)
- Custody seals
- Chain-of-custody form
- Survey documentation/radiation screening results (if shipping from DOE or radiological sites)
- Orientation labels
- Exempted quantities label
- Consignor/consignee labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

7.5 PACKAGING

The following steps are to be followed when packaging limited quantity samples shipments.

- The cooler is to be surveyed by a qualified radiation control technician to ensure the exterior surfaces do not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.

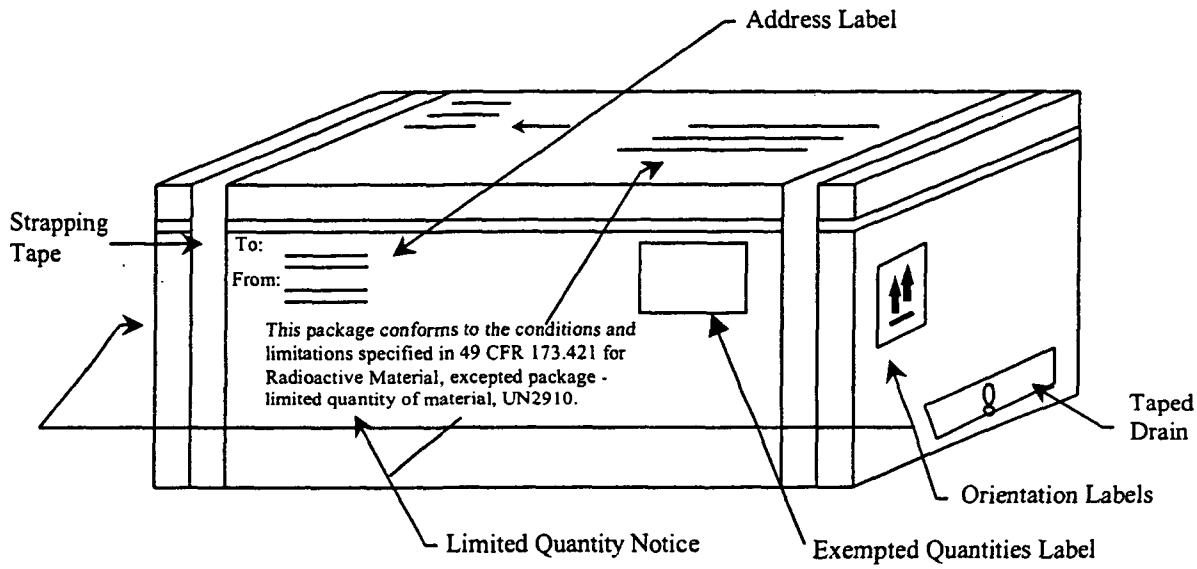
- Place sufficient amount of vermiculite, or approved packaging material, in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- If required, place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- Place a label marked "Radioactive" on the outside of the sealed bag.
- Enclose a notice that includes the name of the consignor or consignee and the following statement: "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910.
- The maximum weight of the package shall not exceed 30 kg (66 lbs) for any limited quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a Ziploc®-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- If a cooler is used, wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix package orientation labels on two opposite sides of the cooler/package.
- Affix a completed Excepted Quantities label to the side of the cooler/package.
- Secure any marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of the cooler labeling/marking is shown in Figure 2.

NOTE: No marking or labeling can be obscured by strapping or duct tape.

- Complete the Shipment Quality Assurance Checklist (Appendix B).

NOTE: Except as provided in 49 CFR 173.426, the package will not contain more than 15 grams of ^{235}U.
NOTE: A declaration of dangerous goods is not required.

Figure 2 Radioactive Material - Limited Quantity Cooler Marking Example



8.0 REFERENCES

U.S. Environmental Protection Agency, *Sampler's Guide to the Contract Laboratory Program*, EPA/540/P-90/006, December 1990.

U.S. Environmental Protection Agency, Region IV, *Standard Operating Procedures and Quality Assurance Manual*, February 1991.

APPENDIX A
Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited Quantity

Sample Packaging

Yes	No	N/A	
☐	☐	☐	The VOA vials are wrapped in bubble wrap and placed inside a Ziploc®-type bag.
☐	☐	☐	The VOA vials are placed into a polyethylene bottle, filled with vermiculite, and tightly sealed.
☐	☐	☐	The drain plug is taped inside and outside to ensure control of interior contents.
☐	☐	☐	The samples have been placed inside garbage bags with sufficient bags of ice to preserve samples at 4°C.
☐	☐	☐	The cooler exceeds the 66-pound limit for limited quantity shipment.
☐	☐	☐	The garbage bag has been sealed with tape (or tied) to prevent movement during shipment.
☐	☐	☐	The chain-of-custody has been secured to the interior of the cooler lid.
☐	☐	☐	The cooler lid and sides have been taped to ensure a seal.
☐	☐	☐	The custody seals have been placed on both the front and back hinges of the cooler, using waterproof tape.

Air Waybill Completion

Yes	No	N/A	
☐	☐	☐	Section 1 has the shipper's name, company and address; the account number, date, internal billing reference number; and the telephone number where the shipper can be reached.
☐	☐	☐	Section 2 has the recipient's name and company along with a telephone number where they can be reached.
☐	☐	☐	Section 3 has the **Bill Sender** box checked.
☐	☐	☐	Section 4 has the **Standard Overnight** box checked.
☐	☐	☐	Section 5 has the **Deliver Weekday** box checked.
☐	☐	☐	Section 6 has the number of packages and their weights filled out. Was the total of all packages and their weights figured up and added at the bottom of Section 6?
☐	☐	☐	Under the **Transport Details** box, the **Cargo Aircraft Only** box is obliterated, leaving only the **Passenger and Cargo Aircraft** box.
☐	☐	☐	Under the **Shipment Type**, the **Radioactive** box is obliterated, leaving only the **Non-Radioactive** box.
☐	☐	☐	Under the **Nature and Quantity of Dangerous Goods** box, the **Proper Shipping Name, Class or Division, UN or ID No., Packing Group, Subsidiary Risk, Quantity and Type of Packing, Packing Instructions and Authorization** have been filled out for the type of chemical being sent.
☐	☐	☐	The **Name, Place & Date, Signature, and Emergency Telephone number** appears at the bottom of the FedEx Airbill.
☐	☐	☐	The statement "In accordance with IATA/ICAO" appears in the **Additional Handling Information** box.

Proper Shipping Name	Class or Division	UN or ID No.	Packing Group	Sub Risk	Quantity	Packing Instruction	Authorization
Hydrochloric Acid Solution	8	UN1789	II		1 plastic box × 0.5 L	Y809	LTD QTY
Nitric Acid Solution (with less than 20%)	8	UN2031	II		1 plastic box × 0.5 L	Y807	LTD QTY
Sodium Hydroxide Solution	8	UN1824	II		1 plastic box × 0.5 L	Y809	LTD QTY
Sulfuric Acid Solution	8	UN2796	II		1 plastic box × 0.5 L	Y809	LTD QTY
Hexanes	3	UN1208	II		1 plastic box × 1 L	Y305	LTD QTY

Sample Cooler Labeling

Yes	No	N/A	
❑	❑	❑	The proper shipping name, UN number, and LTD. QTY. appears on the shipping container.
❑	❑	❑	The corresponding hazard labels are affixed on the shipping container; the labels are not obscured by tape.
❑	❑	❑	The name and address of the shipper and receiver appear on the top and side of the shipping container.
❑	❑	❑	The air waybill is attached to the top of the shipping container.
❑	❑	❑	**Up Arrows** have been attached to opposite sides of the shipping container.
❑	❑	❑	Packaging tape does not obscure markings or labeling.

APPENDIX B
SHIPMENT QUALITY ASSURANCE CHECKLIST

Date: _____ Shipper: _____ Destination: _____

Item(s) Description: _____

Radionuclide(s): _____

Radiological Survey Results: surface _____mrem/hr 1 meter _____

Instrument Used: Mfgr: _____ Model: _____

S/N: _____ Cal Date: _____

LIMITED QUANTITY OR INSTRUMENT AND ARTICLE

Yes	No		
___	___	1.	Strong tight package (package that will not leak material during conditions normally incidental to transportation).
___	___	2.	Radiation levels at any point on the external surface of package less than or equal to 0.5 mrem/hr.
___	___	3.	Removable surface contamination less than 20 dpm/100 cm^2 (alpha) and 1000 dpm/100 cm^2 (beta/gamma).
___	___	4.	Outside inner package bears the marking "Radioactive".
___	___	5.	Package contains less than 15 grams of ^{235}U (check yes if ^{235}U not present).
___	___	6.	Notice enclosed in or on the package that includes the consignor or consignee and the statement, "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."
___	___	7.	Activity less than that specified in 49 CFR 173.425. Permissible package limit: Package Quantity:
___	___	8.	On all air shipments, the statement, Radioactive Material, excepted package-limited quantity of material shall be noted on the air waybill.

Qualified Shipper: _____ Signature: _____

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Project Specific Modification

SOP No.: 2-2

SOP Title: Guide to Handling Investigation-Derived Waste

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for disposing of Libby amphibole asbestos contaminated IDW are different than CDM Technical SOP 2-2. These modifications are necessary for the entire duration of the project.

All IDW will be handled in accordance with CDM Technical SOP 2-2, Guide to Handling Investigation-Derived Waste, with the following modifications:

Section 5.2, Off Site Disposal - All IDW (not including excess soil volume) will be collected in transparent garbage bags and marked "IDW" with an indelible marker. These bags will be deposited into the asbestos contaminated waste stream for deposal at the mine.

GUIDE TO HANDLING INVESTIGATION-DERIVED WASTE

Prepared: Tim Eggert Technical Review: Mike Profit

QA Review: Krista Lippoldt Approved: _____ Signature/Date

Issued: _____ Signature/Date

1.0 OBJECTIVE

This standard operating procedure (SOP) presents guidance for the management of investigation-derived waste (IDW). The primary objectives for managing IDW during field activities include:

- Leaving the site in no worse condition than existed prior to field activities
- Remove wastes which pose an immediate threat to human health or the environment
- Proper handling of onsite wastes that do not require off site disposal or extended above-ground containerization
- Complying with federal, state, and facility applicable or relevant and appropriate requirements (ARARs)
- Careful planning and coordination of IDW management options
- Minimizing the quantity of IDW

2.0 BACKGROUND

2.1 Definitions

Hazardous Waste – Discarded material that is regulated listed waste, or waste that exhibits ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.3 or state regulations.

Investigation-Derived Wastes (IDWs) - Discarded materials resulting from field activities such as sampling, surveying, drilling, excavations, and decontamination processes that, in present form, possess no inherent value or additional usefulness without treatment. Wastes may be solid, liquid, or gaseous, or multiphase materials that may be classified as hazardous or non-hazardous.

Mixed-Waste - Any material that has been classified as hazardous and radioactive.

Radioactive Wastes – Discarded materials that are contaminated with radioactive constituents with specific activities in concentrations greater than the latest regulatory criteria (i.e., 10 CFR 20).

Treatment, Storage, and Disposal Facility (TSDF) - Permitted facilities which accept hazardous waste shipments for further treatment, storage, and/or disposal. These facilities must be permitted by the U.S. Environmental Protection Agency (EPA) and appropriate state agencies.

2.2 Discussion

Field investigation activities result in the generation of waste materials that may be characterized as a hazardous or radioactive waste. IDWs may include drilling muds, cuttings, and purge water from test pit and well installation; purge water, soil, and other materials from collection of samples; residues from testing of treatment technologies and pump and treat systems; personal protective equipment (PPE); solutions (aqueous or otherwise) used to decontaminate non-disposable protective clothing and equipment; and other wastes or supplies used in sampling and testing potentially hazardous or radiologically contaminated material.

NOTE: The client's representatives may not be aware of all potential contaminants. The management of IDW must comply with regulatory requirements that are applicable.

3.0 RESPONSIBILITIES

Site Manager - The site manager is responsible for ensuring that all IDW procedures are conducted in accordance with this SOP. The site manager is also responsible for ensuring that handling of IDW is in accordance with site-specific requirements.

Project Manager - The project manager is responsible for identifying site-specific requirements for the disposal of IDW in accordance with federal, state, and/or facility requirements.

Field Crew Members - Field crew members are responsible for implementing this SOP and communicating any unusual or unplanned condition to the project manager's attention.

4.0 REQUIRED EQUIPMENT

Equipment required for IDW containment will vary according to site-specific/client requirements. Management decisions concerning the necessary equipment required should consider: containment method, sampling, labeling, maneuvering, and storage (if applicable). Equipment must be on site and inspected before commencing work.

4.1 IDW Containment Devices

The appropriate containment device (drums, tanks, etc.) will depend on site- or client-specific requirements and the ultimate disposition of the IDW. Typical IDW containment devices can include:

- Plastic sheeting (polyethylene) with a minimum thickness of 20 millimeters
- Department of Transportation (DOT) approved steel containers
- Bulk storage tanks comprised of polyethylene or steel

Containment of IDW should be segregated by waste type (i.e., solid or liquid, corrosive or flammable, etc.) and source location. Volume of the appropriate containment device should be site-specific.

4.2 IDW Container Labeling

A "Waste Container" or "IDW Container" label or indelible marking should be applied to each container. Labeling or marking requirements for onsite IDW not expected to be transported off site are:

- Labels and markings that contain the following information: project name; generation date; location of waste origin; container identification number; sample number (if applicable); contents (drill cuttings, purge water, PPE, etc.).
- Each label or marking will be applied to the upper one-third of the container at least twice, on opposite sides.
- Containers that are five-gallons or less may only require one label or set of markings.
- Labels or markings will be positioned on a smooth part of the container. The label must not be affixed across container bungs, seams, ridges, or dents.
- Labels must be constructed of a weather-resistive material with markings made with a permanent marker or paint pen and capable of enduring the expected weather conditions. If markings are used, the color must be easily distinguishable from the drum color.
- Labels will be secured in a manner to ensure the label remains affixed to the container.

Labeling or marking requirements for IDW expected to be transported off site must be in accordance with the requirements of 49 CFR 172.

4.3 IDW Container Movement

Staging areas for IDW containers should be predetermined and in accordance with site-specific and/or client requirements. Arrangements should be made prior to field mobilization as to the methods and personnel required to safely transport IDW containers to the staging area. Transportation off site onto a public roadway is prohibited unless 49 CFR 172 requirements are met.

4.4 IDW Container Storage

Containerized IDW should be staged pending chemical analysis or further onsite treatment. Staging areas and bulk storage procedures are to be determined according to site-specific requirements. Containers are to be stored in such a fashion that the labels can be easily read. A secondary/spill container must be provided as appropriate.

5.0 PROCEDURES

The three general options for managing IDW are (1) collection and onsite disposal; (2) collection for off site disposal; and (3) collection and interim management. Attachment 1 summarizes media-

specific information on generation processes and management options. The option selected should take into account the following factors:

- Type (soil, sludge, liquid, debris), quantity, and source of IDW
- Risk posed by managing the IDW on site
- Compliance with regulatory requirements
- IDW minimization and consistency with the IDW remedy and the site remedy

In all cases the client should approve the plans for IDW. Formal plans for the management of IDW must be prepared as part of a work plan or separate document.

5.1 Onsite Disposal

5.1.1 Soil/Sludge/Sediment

The options for handling soil/sludge/sediment IDW are as follows:

1. Return to boring, pit, or source immediately after generation as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).

2. Spread around boring, pit, or source within the area of contamination (AOC) as long as returning the media to these areas will not increase site risks (e.g., direct contact with surficial contamination).

3. Consolidate in a pit within the AOC as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).

4. Send to onsite TSDF - may require analytical analysis prior to treatment/disposal.

NOTE: These options may require client and/or regulatory approval.

5.1.2 Aqueous Liquids

The options for handling aqueous liquid IDW are as follows:

1. Discharge to surface water, only when IDW is not contaminated.

2. Discharge to ground surface close to the well, only if soil contaminants will not be mobilized in the process and the action will not contaminate clean areas. If IDW from the sampling of background up-gradient wells is not a community concern nor associated with soil contamination, this presumably uncontaminated IDW may be released on the ground around the well.

3. Discharge to sanitary sewer.

4. Send to onsite TSDF - may require analysis prior to treatment/disposal.

NOTE: These options may require analytical results to obtain client and/or regulatory approval.

5.1.3 Disposable PPE

The options for handling disposable PPE are as follows:

1. Double-bag contents in non-transparent trash bags and place in onsite industrial dumpster, only if PPE is not contaminated.

2. Containerize, label, and send to onsite TSDF - may require analysis prior to treatment/ disposal.

5.2 Off Site Disposal

Before sending to an offsite TSDF, analysis may be required. Also, manifests are required. Arrangements must be made with the client responsible for the site; it is CDM Federal's policy not to sign manifests. The TSDF and transporter must be permitted for the respective wastes.

5.2.1 Soil/Sludge/Sediment

When the final site remedy requires off site treatment and disposal, the IDW may be stored (e.g., drummed, covered in a waste pile) or returned to its source until final disposal. The management option selected should take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.2 Aqueous Liquids

When the final site remedy requires off site treatment and disposal, the IDW may be stored (e.g., mobile tanks or drums) until final disposal. The management option selected should take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.3 Disposable PPE

When the final site remedy requires off site treatment disposal, the IDW may be containerized and stored. The management option selected should take into account potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.3 Interim Measures

All interim measures must be approved by the client and regulatory agencies.

1. Storing IDW on site until the final action may be practical in the following situations:

   A. Returning wastes (especially sludges and soils) to their onsite source area would require re-excavation for disposal in the final remediation alternative.

   B. Interim storage in containers may be necessary to provide adequate protection to human health and the environment.

   C. Off site disposal options may trigger land disposal regulations under the Resource Conservation and Recovery Act (RCRA). Storing IDW until the final disposal of all wastes from the site will eliminate the need to address this issue more than once.

   D. Interim storage may be necessary to provide time for sampling and analysis.

2. Segregate and containerize all waste for future treatment and/or disposal.

   A. Containment options for soil/sludge/sediment may include drums or covered waste piles in AOC.

   B. Containment options for aqueous liquids may include mobile tanks or drums.

   C. Containment options for PPE may include drums or roll-off boxes.

6.0 RESTRICTIONS/LIMITATIONS

SITE MANAGERS SHOULD DETERMINE THE MOST APPROPRIATE DISPOSAL OPTION FOR AQUEOUS LIQUIDS ON A SITE-SPECIFIC BASIS. Parameters to consider, especially when determining the level of protection, include the volume of IDW, the contaminants present in the groundwater, the presence of contaminants in the soil at the site, whether the groundwater or surface water is a drinking water supply, and whether the groundwater plume is contained or moving. Special disposal/handling may be needed for drilling fluids because they may contain significant solid components.

Disposable sampling materials, disposable PPE, decontamination fluids, etc. will always be managed on a site-specific basis. **UNDER NO CIRCUMSTANCES SHOULD THESE TYPES OF MATERIALS BE BROUGHT BACK TO THE OFFICE OR WAREHOUSE.**

7.0 REFERENCES

Environmental Resource Center, *Hazardous Waste Management Compliance Handbook*, Van Nostrand Reinhold, 1992.

Institute of Hazardous Materials Management, *Handbook on Hazardous Materials Management*, 4th Ed., 1992.

U. S. Environmental Protection Agency, Region IV, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, May 1996 and 1997 revisions.

U. S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1, 1987.

U. S. Environmental Protection Agency, *Management of Investigation-Derived Wastes During Site Inspections*, EPA/540/G-91/009, May 1991.

U. S. Environmental Protection Agency, *Low-Level Mixed Waste: A RCRA Perspective for NRC Licensees*, EPA/530-SW-90-057, August 1990.

U. S. Environmental Protection Agency, *Guide to Management of Investigation-Derived Wastes*, 9345.3-03FS, January 1992.

ATTACHMENT 1
IDW MANAGEMENT OPTIONS

TYPE OF IDW	GENERATION PROCESSES	MANAGEMENT OPTIONS
Soil	• Well/Test pit installations • Borehole drilling • Soil sampling	**Onsite Disposal** • Return to boring, pit, or source immediately after generation • Spread around boring, pit, or source within the AOC • Consolidate in a pit (within the AOC) • Send to onsite TSDF **Off site Disposal** • Client to send to off site TSDF **Interim Management** • Store for future treatment and/or disposal
Sludge/Sediment	• Sludge pit/sediment sampling	**Onsite Disposal** • Return to boring, pit, or source immediately after generation • Send to onsite TSDF **Off site Disposal** • Client to send to off site TSDF **Interim Management** • Store for future treatment and/or disposal
Aqueous liquids (groundwater, surface water, drilling fluids, wastewaters)	• Well installation/development • Well purging during sampling • Groundwater discharge during pump tests • Surface water sampling • Waste water sampling	**Onsite Disposal** • Pour onto ground close to well (non-hazardous waste) • Discharge to sewer • Send to onsite TSDF **Off site Disposal** • Client to send to off site commercial treatment unit • Client to send to publicly owned treatment works (POTW) **Interim Management** • Store for future treatment and/or disposal
Decontamination fluids	• Decontamination of PPE and equipment	**Onsite Disposal** • Send to onsite TSDF • Evaporate (for small amounts of low contamination organic fluids) • Discharge to ground surface **Off site Disposal** • Client to send to off site TSDF • Discharge to sewer **Interim Management** • Store for future treatment and/or disposal

ATTACHMENT 1
IDW MANAGEMENT OPTIONS

TYPE OF IDW	GENERATION PROCESSES	MANAGEMENT OPTIONS
Disposable PPE and Sampling Equipment	• Sampling procedures or other onsite activities	**Onsite Disposal** • Place in onsite industrial dumpster • Send to onsite TSDF **Off site Disposal** • Client to send to off site TSDF **Interim Management** • Store for future treatment and/or disposal

Adapted from U.S. Environmental Protection Agency, Guide to Management of Investigation-Derived Wastes, 9345-03FS, January 1992.

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Project-Specific Modification

SOP No.: 4-1

SOP Title: Field Logbook Content and Control

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures field logbook completions are different than CDM Technical SOP 4-1. These modifications are necessary for the entire duration of the project.

All content and control of will logbooks will be done accordance with CDM Technical SOP 4-1, Field Logbook Content and Control, with the following modifications:

Section 5.2, Operation – A new page will be completed for each property where information is collected for RI activities. The header information will include the address, the name of the property owner, and the building identification number of structures on the property.

When following the line-out and signature procedures to close a logbook page, the author must also print their name under the signature.

FIELD LOGBOOK CONTENT AND CONTROL

SOP 4-1
Revision: 4
Date: June 20, 2001

Prepared: Del Baird
Technical Review: Larry Davidson
QA Review: David O. Johnson
Approved: Signature/Date
Issued: Courtney J. Gustin 6/26/01
Signature/Date

1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to set CDM Federal criteria for content entry and form of field logbooks. Field logbooks are an essential tool to document field activities for historical and legal purposes.

2.0 BACKGROUND

2.1 Definitions

Biota - The flora and fauna of a region.

Magnetic Declination Corrections - Compass adjustments to correct for the angle between magnetic north and geographical meridians.

2.2 Discussion

Information recorded in field logbooks includes field team names, observations, data, calculations, date/time, weather, and description of the data collection activity, methods, instruments, and results. Additionally, the logbook may contain deviations from plans and descriptions of wastes, biota, geologic material, and site features including sketches, maps, or drawings as appropriate.

3.0 RESPONSIBILITIES

Field Team Leader (FTL) - The FTL is responsible for ensuring that the format and content of data entries are in accordance with this procedure.

Site Personnel - All CDM Federal employees who make entries in field logbooks during onsite activities are required to read this procedure prior to engaging in this activity. The FTL will assign field logbooks to site personnel who will be responsible for their care and maintenance. Site personnel will return field logbooks to the records file at the end of the assignment.

4.0 REQUIRED EQUIPMENT

- Site-specific plans
- Field notebook
- Indelible black or blue ink pen
- Ruler or similar scale

5.0 PROCEDURES

5.1 Preparation

In addition to this SOP, site personnel responsible for maintaining logbooks must be familiar with all procedures applicable to the field activity being performed. These procedures should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation. These procedures should be located at the field office.

Field logbooks shall be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the logbook. Prior to use in the field, each logbook will be marked with a specific document control number issued by the document control administrator, if required by the contract quality implementation plan (QIP). Not all contracts require document control numbers. The following information shall be recorded on the cover of the logbook:

- Field logbook document control number.
- Activity (if the logbook is to be activity-specific) and location.
- Name of CDM Federal contact and phone number(s).
- Start date.
- In specific cases, special logbooks may be required (e.g., waterproof paper for storm water monitoring).

The first few (approximately five) pages of the logbook will be reserved for a table of contents (TOC). Mark the first page with the heading and enter the following:

TABLE OF CONTENTS

Date/Description	Page
(Start Date)/Reserved for TOC	1-5

The remaining pages of the table of contents will be designated as such with "TOC" written on the top center of each page.

5.2 Operation

The following is a list of requirements that must be followed when using a logbook:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the logbook. If data collection forms are specified by an activity-specific plan, this information need not be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.
- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Do not erase or blot out any entry at any time. Indicate any deletion by a single line through the material to be deleted. Initial and date each deletion. Take care to not obliterate what was written previously.
- Do not remove any pages from the book.

Specific requirements for field logbook entries include:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial and date all changes.
- Multiple authors must sign out the logbook by inserting the following:

  Above notes authored by:
  - (Sign name)
  - (Print name)
  - (Date)

- A new author must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:

  - Date and time
  - Name of individual making entry
  - Names of field team and other persons on site
  - Description of activity being conducted including station or location (i.e., well, boring, sampling location number) if appropriate
  - Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data
  - Level of personal protection to be used
  - Serial numbers of instruments
  - Required calibration information
  - Serial/tracking numbers on documentation (e.g., carrier air bills)

Entries into the field logbook shall be preceded with the time (written in military units) of the observation. The time should be recorded frequently and at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form required by an operating procedure. In these cases, the logbook must reference the automatic data record or form.

At each station where a sample is collected or an observation or measurement made, a detailed description of the location of the station is required. Use a compass (include a reference to magnetic declination corrections), scale, or nearby survey markers, as appropriate. A sketch of station location may be warranted. All maps or sketches made in the logbook should have descriptions of the features shown and a direction indicator. It is preferred that maps and sketches be oriented so that north is toward the top of the page. Maps, sketches, figures, or data that will not fit on a logbook page should be referenced and attached to the logbook to prevent separation.

Other events and observations that should be recorded include:

- Changes in weather that impact field activities.
- Deviations from procedures outlined in any governing documents. Also record the reason for any noted deviation.
- Problems, downtime, or delays.
- Upgrade or downgrade of personal protection equipment.

5.3 Post-Operation

To guard against loss of data due to damage or disappearance of logbooks, completed pages shall be periodically photocopied (weekly, at a minimum) and forwarded to the field or project office. Other field records shall be photocopied and submitted regularly and as promptly as possible to the office. When possible, electronic media such as disks and tapes should be copied and forwarded to the project office.

At the conclusion of each activity or phase of site work, the individual responsible for the logbook will ensure that all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed and dated). The completed logbook shall be submitted to the records file.

6.0 RESTRICTIONS/LIMITATIONS

Field logbooks constitute the official record of onsite technical work, investigations, and data collection activities. Their use, control, and ownership are restricted to activities pertaining to specific field operations carried out by CDM Federal personnel and their subcontractors. They are documents that may be used in court to indicate dates, personnel, procedures, and techniques employed during site activities. Entries made in these notebooks should be factual, clear, precise, and non-subjective. Field logbooks, and entries within, are not to be utilized for personal use.

7.0 REFERENCES

Sandia National Laboratories, *Procedure for Preparing, Sampling and Analysis Plan, Site-Specific Sampling Plan, and Field Operating Procedures*, QA-02-03, Albuquerque Environmental Program Department 3220, Albuquerque, New Mexico, 1991.

Sandia National Laboratories, Division 7723, *Field Operation Procedure for Field Logbook Content and Control, Environmental Restoration Department*, Albuquerque, New Mexico, 1992.

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Project-Specific Modification

SOP No.: 4-2

SOP Title: Photographic Documentation of Field Activities

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/12/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for photographs taken by digital cameras are different than the current SOP.

All photographs will be recorded in accordance with CDM Technical SOP 4-2, Photographic Documentation of Field Activities, with the following modifications:

Section 5.2.2, General Guidelines for Still Photography - A slate is not required for each new roll of film. The information for the slate will be recorded in the field logbook. The numbers assigned by the digital camera will be used instead of the photographer assigning the number. The caption information will either be on the back of the photograph or the photograph will be numbered or labeled and the caption information listed next to the number or label in the photograph log. On the digital photos, a caption will be included in the picture stating property address/location, date, and name of feature. All team members, as stated in the logbook, will be photographers and witnesses at the property. Slates are not required for close-up photographs. Instead the required information can be listed in the logbook or photograph log. A color strip is not required for close-up or feature photographs.

Section 5.2.4, Photographic Documentation - The name of the laboratory, time and date of drop-off, and receipt of film is not required to be recorded for this project.

Project-Specific Modification

Section 5.3.2, Archive Procedures - Digital photographs will be archived on compact discs. These discs will be assigned a document control dumber written on the disc case as well as well as the disc.

PHOTOGRAPHIC DOCUMENTATION OF FIELD ACTIVITIES

Prepared: David O. Johnson

Technical Review: Jackie Mosher

QA Review: Doug Updike

Approved: _____ 10/12/01
Signature/Date

Issued: Rose Mary Gustin 10/12/01
Signature/Date

1.0 OBJECTIVE

The purpose of this standard operating procedure (SOP) is to provide standard guidelines and methods for photographic documentation, which include still and digital photography and videotape recordings of field activities and site features (geologic formations, core sections, lithologic samples, water samples, general site layout, etc.). This document shall provide guidelines designed for use by a professional or amateur photographer. This SOP is intended for circumstances when formal photographic documentation is required. Based on project requirements, it may not be applicable for all photographic activities.

2.0 BACKGROUND

2.1 Definitions

Photographer – A photographer is the camera operator (professional or amateur) of still photography, including digital photography, or videotape recording whose primary function with regard to this SOP is to produce documentary or data-oriented visual media.

Identifier Component – Identifier components are visual components used within a photograph such as visual slates, reference markers, and pointers.

Standard Reference Marker – A standard reference marker is a reference marker that is used to indicate a feature size in the photograph and is a standard length of measure, such as a ruler, meter stick, etc. In limited instances, if a ruled marker is not available or its use is not feasible, it can be a common object of known size placed within the visual field and used for scale.

Slates – Slates are blank white index cards or paper used to present information pertaining to the subject/ procedure being photographed. Letters and numbers on the slate will be bold and written with black, indelible marking pens.

Arrows and Pointers – Arrows and pointers are markers/pointers used to indicate and/or draw attention to a special feature within the photograph.

Contrasting Backgrounds – Contrasting backgrounds are backdrops used to lay soil samples, cores, or other objects on for clearer viewing and to delineate features.

Data Recording Camera Back – A data recording camera back is a camera attachment or built-in feature that will record, at the very least, frame numbers and dates directly on the film.

2.2 Discussion

Photographs and videotape recordings made during field investigations are used as an aid in documenting and describing site features, sample collection activities, equipment used, and possible lithologic interpretation. This SOP is designed to illustrate the format and desired placement of identifier components, such as visual slates, standard reference markers, and pointers. These items shall become an integral part of the "visual media" that, for the purpose of this document, shall encompass still photographs, digital photographs, and videotape recordings (or video footage). The use of a photographic logbook and standardized entry procedures are also outlined. These procedures and guidelines will minimize potential ambiguities that may arise when viewing the visual media and ensure the representative nature of the photographic documentation.

2.3 Associated Procedures

- CDM Federal SOP 4-1, Field Logbook Content and Control

3.0 RESPONSIBILITIES

Field Team Leader (FTL) – The FTL is responsible for ensuring that the format and content of photographic documentation are in accordance with this procedure. The FTL is responsible for directing the photographer to specific situations, site features, or operations that the photographer will be responsible for documenting.

Photographer – The photographer shall seek direction from the FTL and regularly discuss the visual documentation requirements and schedule. The photographer is responsible for maintaining a logbook per Sections 5.1, 5.2.4, and 5.3.1 of this SOP.

4.0 REQUIRED EQUIPMENT

The following is a general list of equipment that may be used:

- 35mm camera or disposable single use camera (35mm or panoramic use)
- Digital camera
- Video camera
- Logbook
- Indelible black or blue ink pen
- Standard reference markers
- Slates
- Arrows or pointers

- Contrasting backgrounds
- Medium speed, or multi purpose fine-grain, color, 35 mm, negative film or slide film (project dependent)
- Data recording camera back (if available)
- Storage medium for digital camera

5.0 PROCEDURES

5.1 Documentation

A commercially available, bound logbook will be used to log and document photographic activities. Review the CDM Federal SOP 4-1 (Field Logbook Content and Control) and prepare all supplies needed for logbook entries.

Note: A separate photographic logbook is not required. A portion of the field logbook may be designated as the photographic log and documentation section.

5.1.1 Field - Health and Safety Considerations

There are no hazards that an individual will be exposed to specific to photographic documentation. However, site-specific hazards may arise depending on location or operation. Personal protective equipment used in this operation will be site-specific and dictated through requirements set by the site safety officer, site health and safety plan, and/or prescribed by the CDM Federal Corporate Health and Safety Program. The photographer should contact the site safety officer for health and safety orientation prior to commencing field activities. The site health and safety plan must be read prior to entry to the site, and all individuals must sign the appropriate acknowledgement that this has been done.

The photographer should be aware of any potential physical hazards while photographing the subject (e.g., low overhead hazard, edge of excavation).

5.2 OPERATION

5.2.1 General Photographic Activities in the Field

The following sections provide general guidelines that should be followed to visually document field activities and site features using still/digital cameras and video equipment. Listed below are general suggestions that the photographer should consider when performing activities under this SOP:

- The photographer should be prepared to make a variety of shots, from closeup to wide-angle. Many shots will be repetitive in nature or format especially closeup site feature photographs. Consideration should therefore be given to designing a system or technique that will provide a reliable repetition of performance.

- All still film photographs should be made using a medium speed, or multi purpose fine-grain, color negative film in the 35 mm format unless otherwise directed by the FTL.
- It is suggested that Kodak brand "Ektapress Gold Deluxe" film or equivalent be used as the standard film for the still photography requirements of the field activities. This film is stable at room temperature after exposure and will better survive the time lag between exposure and processing. It is suggested that film speed ASA 100 should be used for outdoor photographs in bright sunlight, ASA 200 film should be used in cloudy conditions, and ASA 400 film should be used indoors or for very low-light outdoor photographs.
- No preference of videotape brand or digital storage medium is specified and is left to the discretion of the photographer.
- The lighting for sample and feature photography should be oriented toward a flat condition with little or no shadow. If the ambient lighting conditions are inadequate, the photographer should be prepared to augment the light (perhaps with reflectors or electronic flash) to maintain the desired visual effect.
- Digital cameras have multiple photographic quality settings. A camera that obtains a higher resolution (quality) has a higher number of pixels and will store a fewer number of photographs per digital storage medium.

5.2.2 General Guidelines for Still Photography

Slate Information

When directed by the FTL, each new roll of film or digital storage medium shall contain upon the first usable frame (for film) a slate with consecutively assigned control numbers (a consecutive, unique number that is assigned by the photographer as in sample numbers).

Caption Information

All still photographs will have a full caption permanently attached to the back or permanently attached to a photo log sheet. The caption should contain the following information (digital photographs should have a caption added after the photographs are downloaded):

- Film roll control number (if required) and photograph sequence number
- Date and time
- Description of activity/item shown
- Direction (if applicable)
- Photographer

When directed by the FTL, a standard reference marker should be used in all documentary visual media. While the standard reference marker will predominantly be used in closeup feature documentation, inclusion in all scenes should be considered.

Digital media should be downloaded at least once each day.

Closeup and Feature Photography

When directed by the FTL, closeup photographs should include a standard reference marker of appropriate size as an indication of the feature size and contain a slate marked with the site name and any identifying label, such as a well number or core depth, that clearly communicates to the viewer the specific feature being photographed.

Feature samples, core pieces, and other lithologic media should be photographed as soon as possible after they have been removed from their in situ locations. This enables a more accurate record of their initial condition and color. When directed by the FTL, include a standard reference color strip (color chart such as Munsell Soil Color Chart or that available from Eastman Kodak Co.) within the scene. This is to be included for the benefit of the viewer of the photographic document and serves as a reference aid to the viewer for formal lithologic observations and interpretations.

Site Photography

Site photography, in general, will consist predominantly of medium and wide-angle shots. A standard reference marker should be placed adjacent to the feature or, when this is not possible, within the same focal plane.

While it is encouraged that a standard reference marker and caption/slate be included in the scene, it is understood that situations will arise that preclude their inclusion within the scene. This will be especially true of wide-angle shots. In such a case, the film/tape control number shall be entered in the photographic logbook along with the frame number and all other information pertinent to the scene.

Panoramic

In situations where a wide-angle lens does not provide sufficient subject detail, a single-use disposable panoramic camera is recommended. If this type of camera is not available, a panoramic series of two or three photos would be appropriate. Panoramas can provide greater detail while covering a wide subject, such as an overall shot of a site.

To shoot a panoramic series using a standard 35mm or digital camera, the following procedure is recommended.

- Use a stable surface or tripod to support the camera.
- Allow a 20 to 30 percent overlap while maintaining a uniform horizon.
- Complete 2 to 3 photos per series.

5.2.3 General Photographic Documentation Using Video Cameras

As a reminder, it is not within the scope of this document to set appropriate guidelines for presentation or "show" videotape recording. The following guidelines are set for documentary videotape recordings only and should be implemented at the discretion of the FTL.

Documentary videotape recordings of field activities may include an audio slate for all scenes. At the beginning of each video session, an announcer will recite the following information: date, time (in military units), photographer, site ID number, and site location. This oral account may include any additional information clarifying the subject matter being recorded.

A standard reference marker may be used when taking closeup shots of site features with a video camera. The scene may also include a caption/slate. It should be placed adjacent and parallel to the feature being photographed.

It is recommended that a standard reference marker and caption/slate be included in all scenes. The caption information is vital to the value of the documentary visual media and should be included. If it is not included within the scene, it should be placed before the scene.

Original videotape recordings will not be edited. This will maintain the integrity of the information contained on the videotape. If editing is desired, a working copy of the original videotape recording can be made.

5.2.4 Photographic Documentation

Photographic activities must be documented in a photographic logbook or in a section of the field logbook. The photographer will be responsible for making proper entries.

In addition to following the technical standards for logbook entry as referenced in CDM Federal SOP 4-1, the following information should be maintained in the appropriate logbook:

- Photographer name.
- If required, an entry shall be made for each new roll/tape control number assigned.
- Sequential tracking number for each photograph taken (for digital cameras, the camera-generated number may be used).
- Date and time (military time).
- Location.
- A description of the activity/item photographed.
- If needed, a description of the general setup, including approximate distance between the camera and the subject, may be recorded in the logbook.
- Record as much other information as possible to assist in the identification of the photographic document.

5.3 Post Operation

All film will be sent for development and printing to a photographic laboratory (to be determined by the photographer). The photographer will be responsible for arranging transport of the film from the field to the photographic laboratory. The photographer shall also be responsible for arranging delivery of the negatives and photographs, digital storage medium, or videotape to the project management representative.

5.3.1 Documentation

At the end of each day's photographic session, the photographer(s) will ensure that the appropriate logbook has been completely filled out and maintained as outlined in CDM Federal SOP 4-1.

5.3.2 Archive Procedures

1. Photographs and the associated set of negatives, digital media, and original unedited documentary videotape recordings will be submitted to the project files and handled according to contract records requirements. The FTL will ensure their proper distribution.

2. Completed pages of the appropriate logbook will be copied weekly and submitted to the project files.

6.0 RESTRICTIONS/LIMITATIONS

This document is designed to provide a set of guidelines for the field amateur or professional photographer to ensure that an effective and standardized program of visual documentation is maintained.

It is not within the scope of this document to provide instruction in photographic procedures, nor is it within the scope of this document to set guidelines for presentation or "show" photography.

The procedures outlined herein are general by nature. The FTL is responsible for specific operational activity or procedure. Questions concerning specific procedures or requirements should be directed to the FTL.

NOTE: Some sites do not permit photographic documentation. Check with the site contact for any restrictions.

7.0 REFERENCES

U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3*, February 2001, Appendix F.

U.S. Environmental Protection Agency, Region IV, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Athens, Georgia, May 1996.

U.S. Environmental Protection Agency, National Enforcement Investigations Center, *Multi-Media Investigation Manual*, EPA-330/9-89-003-R, Revised March 1992, p. 85.

Project-Specific Modification

SOP No.: 4-5

SOP Title: Field Equipment Decontamination at Nonradioactive Sites

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for decontamination of Libby amphibole asbestos contaminated field equipment are different than CDM Technical SOP 4-5. These modifications are necessary for the entire duration of the project.

All equipment used to collect, handle, or measure soil samples will be decontaminated in accordance with CDM Technical SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites, with the following modifications:

Section 4.0, Required Equipment - Plastic sheeting will not be used during decontamination procedures. American Society for Testing and Materials (ASTM) Type II water will not be used. Rather, locally available deionized (DI) water will be used.

Section 5.0, Procedures - Decontamination water will not be captured and will be discharged to the ground at the property.

Section 5.6, Waste Disposal - Decontamination water will not be captured and will not be packaged, labeled, or stored as investigation-derived waste (IDW).

FIELD EQUIPMENT DECONTAMINATION AT NONRADIOACTIVE SITES

SOP: 4-5
Revision: 5
Date: December 11, 2002

Prepared: Steven Fundingsland

Technical Review: Laura Spiehal

QA Review: Matt Brookshire

Approved: 12/18/02
Signature/Date

Issued: 12/18/02
Signature/Date

1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to describe the procedures required for decontamination of field equipment.

2.0 BACKGROUND

2.1 Definitions

Clean - Free of visible contamination and when decontamination has been completed in accordance with this SOP.

Cross-Contamination - The transfer of contaminants through equipment or personnel from the contamination source to less contaminated or non-contaminated samples or areas.

Decontamination - The process of rinsing or otherwise cleaning the surfaces of equipment to rid them of contaminants and to minimize the potential for cross contamination of samples or exposure of personnel.

2.2 Discussion

Decontamination of field equipment is necessary to ensure acceptable quality of samples by preventing cross contamination. Further, decontamination reduces health hazards and prevents the spread of contaminants off-site.

3.0 RESPONSIBILITIES

Field Team Leader - The Field Team Leader (FTL) ensures that field personnel are trained in the performance of this procedure and that decontamination is conducted in accordance with this procedure. The FTL may also be required to collect and document rinsate samples to provide quantitative verification that these procedures have been correctly implemented.

4.0 REQUIRED EQUIPMENT

- Stiff-bristle scrub brushes
- Plastic buckets and troughs
- Laboratory-grade detergent, low phosphate (Alconox™, Liquinox ™ or similar)
- Nalgene or Teflon Sprayers or wash bottles or 2- to 5-gallon, manual-pump sprayer (pump sprayer material must be compatible with the solution used)
- Plastic sheeting
- Disposable wipes, rags or paper towels
- Potable water and/or de-ionized water of American Society for Testing and Materials (ASTM) Type II or better, as defined by ASTM Standard Specification for Reagent Water, Standard D 1193-77 (re-approved 1983)*
- Gloves, safety glasses, and other protective clothing as specified in the site-specific health and safety plan
- High-pressure pump with soap dispenser or steam-spray unit (for large equipment only)
- Appropriate decontamination solutions pesticide grade or better and traceable to a source (e.g. 10% and/or 1% nitric acid (HNO3), acetone, methanol, isopropanol, hexane)
- Tools for equipment assembly and disassembly (as required)
- 55-gallon drums or tanks (as required)
- Pallets for drums or tanks holding decontamination water (as required)

* Potable water may be required to be tested for contaminants before use. Check field plan for requirements. ASTM Type II water will include a certificate of quality.

5.0 PROCEDURES

All reusable equipment (non-dedicated) used to collect, handle, or measure samples will be decontaminated before coming into contact with any sample. Decontamination of equipment will occur either at a central decontamination station or at portable decontamination stations set up at the sampling location, drill site, or monitoring well location. The centrally-located decontamination station will include an appropriately sized bermed and lined area on which equipment decontamination will occur and shall be equipped with a collection system and storage vessels. In certain circumstances, berming is not required when small quantities of water are being generated and for some short duration field activities (i.e., pre-remedial sampling). Equipment should be transported to the decontamination station in a manner to prevent cross-contamination of equipment and/or area. Precautions taken may include enclosing augers in plastic wrap while being transported on a flatbed truck.

The decontamination area will be constructed so that contaminated water is either collected directly into appropriate containers (5-gallon buckets or steel wash tubs) or within the berms of the

decontamination area which then drains into a collection system. Water from the collection system will be transferred into 55-gallon drums or portable tanks for storage. Typically, decontamination water will be staged until sampling results or waste characterization results are obtained and evaluated and the proper disposition of the waste is determined. The exact procedure for decontamination waste disposal should be discussed in the field plan. Also, decontamination fluids, such as solvents, may need to be segregated from other investigation-derived wastes.

All items that will come into contact with potentially contaminated media will be decontaminated before use and between sampling and/or drilling locations. If decontaminated items are not immediately used, they will be covered either with clean plastic or aluminum foil depending on the size of the item. All decontamination procedures for the equipment being used are as follows:

General Guidelines

- Potable and de-ionized water should be free of all contaminants of concern. Following the field plan, analytical data from the water source may be required. If required, either existing analytical data from the water source supplier (i.e., municipality, bottled water company, de-ionized water producer) may be obtained or chemical testing may be performed on the selected source.

- Soap will be a low phosphate detergent.

- Sampling equipment that has come into contact with oil and grease will be cleaned with methanol or other approved alternative to remove the oily material. This may be followed by a hexane rinse and then another methanol rinse. Regulatory or client requirements regarding solvent use will be stated in the field plan.

- All solvents will be pesticide grade or better and traceable to a source. The corresponding lot numbers will be recorded in the appropriate logbook.

- Decontaminated equipment will be allowed to air dry before being used.

- Documentation for all cleaning will be recorded in the appropriate logbook.

- Gloves, boots, safety glasses, and any other personnel protective clothing and equipment will be used as specified in the site-specific health and safety plan.

5.1 Heavy Equipment Decontamination

Heavy equipment includes drilling rigs and backhoes. Follow these steps when decontaminating this equipment:

1. Establish a decontamination area with berms that is large enough to fully contain the equipment to be cleaned. If available, an existing wash pad or appropriate paved and bermed area may be utilized; otherwise, use one or more layers of heavy plastic sheeting to cover the ground surface and berms. All decontamination pads should be upwind of the area under investigation.

2. With the rig in place, spray areas (rear of rig or backhoe) exposed to contaminated soils using a hot water high-pressure sprayer. Be sure to spray down all surfaces, including the undercarriage.

3. Use brushes, low phosphate detergent and potable water to remove dirt whenever necessary.

4. Remove equipment from the decontamination pad and allow it to air dry before returning it to the work site.

5. Record equipment type, date, time, and method of decontamination in the appropriate logbook.

6. After decontamination activities are completed, collect all contaminated wastewater, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal as detailed in the field plan. Liquids and solids must be drummed separately.

5.2 Downhole Equipment Decontamination

Downhole equipment decontamination includes hollow-stem augers, drill pipes, casings, screens, etc. Follow these steps when decontaminating this equipment:

1. Set up a centralized decontamination area, if possible. This area should be set up to collect contaminated rinse waters and to minimize the spread of airborne spray.

2. Set up a "clean" area upwind of the decontamination area to receive cleaned equipment for air-drying. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed. All decontamination pads should be upwind of any areas under investigation.

3. Place the object to be cleaned on aluminum foil or plastic-covered wooden sawhorses or other supports.

4. Using low phosphate detergent and potable water in the hot water high-pressure sprayer (or steam unit), spray the contaminated equipment. Aim downward to avoid spraying outside the decontamination area. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt.

5. If using soapy water, rinse the equipment using clean, potable water. If using hot water, the rinse step is not necessary if the hot water does not contain a detergent. If the hot water contains a detergent, this final clean water rinse is required.

6. Using the manual-pump sprayer, rinse the equipment thoroughly with de-ionized water (ASTM Type II or better).

7. Remove the equipment from the decontamination area and place in a clean area upwind to air dry.

8. Record equipment type, date, time, and method of decontamination in the appropriate logbook.

9. After decontamination activities are completed, collect all contaminated wastewaters, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal. Liquids and solids must be drummed separately.

5.3 Sampling Equipment Decontamination

Sampling equipment includes split spoons, spatulas, and bowls used for sample homogenization that directly contact sample media. Follow these steps when decontaminating this equipment:

1. Set up a decontamination line on plastic sheeting. The decontamination line should progress from "dirty" to "clean" and have an area located upwind for drying decontaminated equipment. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or the surfaces on which decontaminated equipment is to be placed for drying.

2. Before washing, disassemble any items that might trap contaminants internally. Do not reassemble these items until decontamination and air-drying are complete. Wash items thoroughly in a bucket of low phosphate detergent and potable water. Use a stiff-bristle brush to dislodge any gross contamination (soil or debris).

3. Rinse the item in potable water. Rinse water should be replaced as needed, generally when cloudy.

4. Using a hand sprayer, wash bottles, or manual-pump sprayer, rinse the item with de-ionized water (ASTM Type II or better).

5. If sampling for metal analytes, rinse the item with 10% nitric acid (for stainless steel, glass, plastic, and Teflon), or 1% nitric acid (for items made of low-carbon steel) followed by a de-ionized water (ASTM Type II or better) rinse.

   NOTE: Care should be taken not to get nitric acid on skin or clothing. This step should not be used unless required by sampling needs as dictated in the field plan.

   CAUTION: Do not allow nitric acid to contact methanol or hexane. Contain nitric acid waste separate from organic solvents.

6. If sampling for organic analytes, rinse the item with methanol or approved organic solvent.

7. If required by the field plan, when sampling for polar organic compounds such as pesticides, polychlorinated biphenyls (PCBs), and fuels, rinse the item with hexane or approved alternatives, followed by a second methanol rinse.

8. Thoroughly rinse the item with de-ionized water (ASTM Type II or better).

9. Allow the item to air dry completely.

10. After drying, reassemble parts as required and wrap the item in clean plastic wrap or in aluminum foil, shiny side out.

11. Record equipment type, date, time, and method of decontamination in the appropriate logbook.

12. After decontamination activities are completed, collect all contaminated waters, used solvents and acids, plastic sheeting, and disposable gloves, boots, and clothing. Place contaminated items in properly labeled drums for disposal. Liquids and solids must be drummed separately. (Refer to site-specific plans for labeling and waste management requirements).

5.4 Pump Decontamination

Follow the manufacturer's recommendation for specified pump decontamination procedures. At a minimum follow these steps when decontaminating pumps:

1. Set up the decontamination area and separate "clean" storage area using plastic sheeting to cover the ground, tables, and other surfaces. Set up three 55-gallon drums and one or more containers of ASTM Type II water (or as specified in the field plan). One drum shall contain dilute (non-foaming) soapy water, the second drum shall contain potable water, and the third drum shall be empty to receive waste water.

2. The pump should be set up in the same configuration as for sampling. Submerge the pump intake (or the pump, if submersible) and all downhole-wetted parts (tubing, piping, foot valve) in the soapy water of the first drum. Place the discharge outlet in the wastewater drum above the level of the wastewater. Pump soapy water through the pump assembly until it discharges to the waste drum. Scrub the outside of the pump and other wetted parts with a metal brush.

3. Move the pump assembly to the potable water drum while leaving discharge outlet in the waste drum. All downhole-wetted parts must be immersed in the potable water rinse. Pump potable water through the pump assembly until it runs clear.

4. Move the pump intake to the ASTM Type II water can. Pump the ASTM Type II water through the pump assembly. Pump the volume of water through the pump specified in the field plan. Usually, three pump-and-line-assembly volumes will be required.

5. Decontaminate the discharge outlet by hand following the steps outlined in Section 5.3.

6. Remove the decontaminated pump assembly to the "clean" area and allow it to air dry upwind of the decontamination area. Intake and outlet orifices should be covered with aluminum foil to prevent the entry of airborne contaminants and particles.

7. Record the equipment type, serial number, date, time, and method of decontamination in the appropriate logbook.

5.5 Instrument Probe Decontamination

Instrument probes used for field measurements such as pH meters, conductivity meters, etc. will be decontaminated between samples and after use with ASTM Type II, or better, water.

5.6 Waste Disposal

Refer to site-specific plans for waste disposal requirements. The following are guidelines for disposing of wastes:

1. All wash water, rinse water, and decontamination solutions that have come in contact with contaminated equipment are to be handled, packaged, labeled, marked, stored, and disposed of as investigation-derived waste.

2. Small quantities of decontamination solutions may be allowed to evaporate to dryness.

3. If large quantities of used decontamination solutions will be generated, each type of waste should be separated in separate containers. This may permit the disposal of wash water and rinse water onsite or in a sanitary sewage treatment plant rather than as a hazardous waste. If an industrial wastewater treatment plant is available onsite, the disposal of acid solutions and solvent-water solutions may be permitted.

4. Unless otherwise required, plastic sheeting and disposable protective clothing may be treated as solid, non-hazardous waste.

5. Waste liquids should be sampled, analyzed for contaminants of concern in accordance with disposal regulations, and disposed of accordingly.

6.0 RESTRICTIONS/LIMITATIONS

Nitric acid and polar solvent rinses are necessary only when sampling for metals or organics respectively. These steps should not be used, unless required, because of the potential for acid burns and ignitability hazards.

If the field equipment is not thoroughly rinsed and allowed to completely air dry before use, volatile organic residue, which interferes with the analysis, may be detected in the samples. The occurrence of residual organic solvents is often dependent on the time of year sampling is conducted. In the summer, volatilization is rapid, and in the winter, volatilization is slow. Check with your EPA region, state, and client for approved decontamination solvents.

7.0 REFERENCES

Department of Energy, Hazardous Waste Remedial Actions Program, *Standard Operating Procedures For Site Characterization*, DOE/HWP-100/R1, September 1996.

Department of Energy, Hazardous Waste Remedial Actions Program, *Quality Control Requirements For Field Methods*, DOE/HWP-69/R2, September 1996.

American Society for Testing and Materials, *Standard Practice for Decontamination of Field Equipment at Nonradioactive Waste Sites*, ASTM D5088-90, June 29, 1990.

U.S. Environmental Protection Agency, Region II, "*CERCLA" Quality Assurance Manual*, Revision 1, 1989.

U.S. Environmental Protection Agency, Region IV, *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual*, 1986.

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1, 1987.

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Project Specific Guidance
Completion of Field Sample Data Sheets (FSDS)

Project: Libby Asbestos Remedial Investigation – Remedial Investigation (RI)

Project No.: 3282-137

Document No.: CDM-LIBBY-03 Revision 1

Prepared by: Dee A. Warren Date: 4/17/03

Approved by:

Project Manager	Date 5/7/03
Technical Reviewer	Date 5/7/03
QA Reviewer	Date 5/12/03
EPA Approval	Date 5/19/03

A field sample data sheet (FSDS) must be completed using the following guidance.

Definitions:

Owner – (As it appears on the property IFF). Person who owns a residential property (may or may not be the current occupant), or the person who owns a commercial property.

Sample Coordinator – person responsible for the custody of all field paper work and samples collected

Soil Field Sample Data Sheet

Sheet No.: Pre-assigned unique sequential sheet number. Completed by sample coordinator.

Scenario No.: Scenario numbers are specific to the Phase II sampling program and do not apply to the RI. "NA" should be placed in this blank.

Field Logbook No.: The logbook number being used to record information specific to the samples on the FSDS.

Page No.: Page number in logbook on which information regarding the samples on the FSDS is recorded.

Sampling Date: Date samples are collected, in the form MM/DD/YY.

Address: (As it appears on the property IFF). The address of the property being sampled. Addresses are to be entered in the following format:

Street number - Direction - Street Name - Street Abbreviation

Where:
Street number = the number of the street address
Direction = the abbreviation of the street direction (N, S, E, or W), when applicable
Street name = correct spelling of the street name
Street abbreviation = when applicable

Road - Rd
Avenue - Ave
Street - St
Circle - Cr
Place - Pl
Boulevard - Blvd
Highway - Hwy

Examples: 510 N Mineral Ave
607 N Michigan Ave
521 Pipe Creek Rd

Business Name: (As it appears on the property IFF). If a business is located on the property, record the name. If a business is not located on the property, record NA.

Owner: (As it appears on the property IFF). Name of the property owner (not necessarily the current occupant).

Land Use: Description of land use on which property is located.

Sampling Team: Company affiliation of sampling team.

Names: Full name of all members of the sampling team.

Index ID: Sample identification (ID) number. Index ID numbers for the RI soil samples are in the form CS-#####. A set of available numbers is assigned to each sampling team by the sample coordinator.

Location ID: Unique identification number assigned to each sample location with a unique global positioning system (GPS) coordinate. For soil samples, location identifications (IDs) are in the form SP-#####. A set of available numbers is assigned to each sampling team by the sample coordinator.

Sample Group: The sample group for soil samples collected for the RI must be one of the following options:

Yard	Flower Bed
Garden	Field
Driveway	Walkway
Road	Park

Location Description: Description of the location where a soil sample was collected. If back yard, front yard, side yard, or driveway does not apply, use the other blank. If the yard sample was composed of sub-samples located in more than one yard location, circle all that apply.

Category: FS = field sample; FD = field duplicate; and FB = field blank. The field duplicate blank should be used to identify the FD of the parent FS.

Matrix Type: The samples collected for the RI will mostly be surface samples (0 to 1 or 0 to 6 inches). If a sample that is collected is not a surface sample, complete the other line using the following options: mining waste, subsurface soil, fill.

Type: Indicate the type of sample collected, grab or composite. If the sample is a composite sample, the number of sub-samples must be provided.

Time: The time of sample collection, in military time.

Top Depth: Top depth of sample in inches below the ground surface.

Bottom Depth: Bottom depth of sample in inches below the ground surface.

Field Comments: Any information specific to a sample. If vermiculite is present, this must be noted in the field comments section.

Entered: Completed by Volpe personnel at time of data entry.

Validated: Completed by Volpe personnel at time of data entry check.

Completed by: Initials of field team member that completes the FSDS.

QC by: Initials of field team member that completes QC check of FSDS.

Dust Field Sample Data Sheet

Sheet No.: Pre-assigned unique sequential sheet number. Completed by sample coordinator.

Scenario No.: Scenario numbers are specific to the Phase II sampling program and do not apply to the RI. "NA" should be placed in this blank.

Field Logbook No.: The logbook number being used to record information specific to the samples on the FSDS.

Page No.: Page number in logbook on which information regarding the samples on the FSDS is recorded.

Sampling Date: Date samples are collected, in the form MM/DD/YY.

Address: (As it appears on the property IFF). The address of the property being sampled. Addresses are to be entered in the following format:

Street number - Direction - Street Name - Street Abbreviation

Where:
Street number = the number of the street address
Direction = the abbreviation of the street direction (N, S, E, or W), when applicable
Street name = correct spelling of the street name
Street abbreviation = when applicable

Road - Rd
Avenue - Ave
Street - St
Circle - Cr
Place - Pl
Boulevard - Blvd
Highway - Hwy

Examples: 510 N Mineral Ave
607 N Michigan Ave
521 Pipe Creek Rd

Business Name: (As it appears on the property IFF). If a business is located on the property, record the name. If a business is not located on the property, record NA.

Owner: (As it appears on the property IFF). Name of the property owner (not necessarily the current occupant).

Land Use: Description of land use on which property is located.

Sampling Team: Company affiliation of sampling team.
Names: Full name of all members of the sampling team.

Index ID: Sample identification (ID) number. Index ID numbers for the RI dust samples are in the form 1-#####. A set of available numbers is assigned to each sampling team by the sample coordinator.

Location ID: Unique identification number assigned to each sample location with a unique global positioning system (GPS) coordinate. For dust samples, location identifications (IDs) are in the form BD-#####. The location ID for dust samples is the BD number of the structure the dust sample is collected in. A set of available numbers is assigned to each sampling team by the sample coordinator.

Matrix Type: Circle the structure type in which the sample is collected. If the best description of the structure is not an option, right a description in the blank provided.

Sample Group: Circle the floor/level the dust sample was collected on. If the best description of the floor/level is not an option, right a description in the blank provided.

Location Description: Circle the location the dust sample was collected per the dust sampling protocol. Circle all locations that apply to the sample. If the best description of the location is not an option, right a description in the blank provided.

Category: FS = field sample or blank. It the cassette was used to collect a sample, circle FS. If the cassette will be submitted as a blank, circle blank.

Sample Area: Circle the amount of area sampled with the cassette.

Filter Diameter: Circle the appropriate filter diameter.

Pore Size: Circle the appropriate pore size.

Flow Meter Type: Circle the type of flow meter used to calibrate the pump flow rate.

Flow Meter ID No.: Record the identification number of the flow meter used to calibrate the pump flow rate.

Pump ID No.: Record the identification number of the pump used to collect the sample.

Start Time: Record the starting time of each sample aliquot collection, in military time.

Start Flow: Record the starting pump flow rate for the sample colleted in Liters per minute (L/min).

Stop Time: Record the stopping time of each sample aliquot collection, in military time.

Stop Flow: Record the stopping pump flow rate for the sample colleted in minute L/min.

Pump Fault: If the pump faulted during sample collection, circle Yes. If the pump did not fault during sample collection, circle No.

Field Comments: For each 100cm2 aliquot locations, record the specific location sampled.

Entered: Completed by Volpe personnel at time of data entry.

Validated: Completed by Volpe personnel at time of data entry check.

Completed by: Initials of field team member that completes the FSDS.

QC by: Initials of field team member that completes QC check of FSDS.

Project Specific Guidance
Completion of Additional Information Field Form (AIFF)

Project: Libby Asbestos Remedial Investigation - Remedial Investigation (RI)

Project No.: 3282-137

Document No.: CDM-LIBBY-06

Prepared by: Dee A. Warren Date: 4/17/03

Approved by:

Project Manager	Date 5/7/03
Technical Reviewer	Date 5/7/03
QA Reviewer	Date 5/12/03
EPA Approval	Date 5/19/03

An additional information field form (IFF) is to be completed for each structure where RI activities are completed. The RI activities are detailed in the RI SAP and based on results of CSS investigations. If any corrections to the AIFF are required, the correction should be made with a single strike out be dated and initialed. The correct information should be entered as close as possible to the information being corrected.

Definitions:

AIFF - additional information field form (AIFF) used to capture information gathered during RI activities at a property.

Occupant - Refers to the person currently living in a primary residential structure.

Additional Information Field Form Completion

Each entry on the AIFF should be completed following the guidance procedure, and any notes on each item should be written in the notes column to the right of each data item.

Header Information

BD#: Refers to the location identification (ID) number of the structure the AIFF is being completed for. The BD# is located on the information field form (IFF) completed during the CSS.

Field Logbook No.: The number of the field logbook that is used to record information specific to the property being assessed on the AFF.

Page No.: The page numbers in the logbook that contain information specific to the property being assessed on the AIFF.

Site Visit Date: Date of site visit, in the form MM/DD/YY.

Address: The address of the property being assessed on the AIFF. Addresses are to be recorded as it appears on the IFF completed for the property.

Structure Description: Description of the structure specific the AIFF (i.e., house, trailer, garage, shed, barn). This should be recorded as it appears on the IFF completed for the property.

Occupant: Name of current occupants of the primary structure. In the case of a commercial property, the occupant information would not be completed. This should be recorded as it appears on the IFF completed for the property, unless the occupant has changed since the IFF was completed. Do not change the information on the IFF.

Occupant Phone number: Phone number of occupant of the primary structure. This should be recorded as it appears on the IFF completed for the property, unless the occupant has changed since the IFF was completed. Do not change the information on the IFF.

Owner: Only needs to be completed if the owner of the structure or property is different than the current occupant (i.e., renter). Required for commercial properties. This should be recorded as it appears on the IFF completed for the property, unless the occupant has changed since the IFF was completed. Do not change the information on the IFF.

Owner Phone number: Phone number of the owner of the property. For residential properties, only complete if the owner is different than the current occupant. Required for commercial properties. This should be recorded as it appears on the IFF completed for the property, unless the occupant has changed since the IFF was completed. Do not change the information on the IFF.

Business Name: Name of business located on the property. This should be recorded as it appears on the IFF completed for the property, unless the occupant has changed since the IFF was completed. Do not change the information on the IFF.

Sampling Team: Full name and company of each member of the team assessing the property (i.e., members sampling and/or completing AIFF).

Field Form Check Completed by (100% of forms): To be signed, after AIFF is checked by the field team member not completing the AIFF.

Screening Field check Completed by (2% of forms): To be signed, for properties the CSS/RI task leader completes a screening field check for.

Indoor Sampling/Attic Inspection

Current presence of VCI - Unknown: If the status of VCI is determined, check yes and follow instructions on the AIFF. If the status of VCI is NOT determined, check no and follow instructions on the AIFF. If the current presence of VCI is something other than unknown, check item does not apply to this property.

Past presence of VCI - Yes: If remnants of vermiculite are visible, check yes and follow instructions on the AIFF. If the remnants are NOT visible, check no and follow instruction on the AIFF. If the presence or absence of remnants cannot be determined, check unknown and follow the instructions on the AIFF. If VCI was not present in the past, check item does not apply to this property.

Secondary Source Indications: If secondary source indications are present, check box provided and follow instructions. If secondary source indicators are NOT present, check item does not apply to this property.

Vermiculite Present in Building Materials: If the condition of the vermiculite containing building material (VCBM) is determined to be friable, check friable and following instructions on the AIFF. If the material is determined to be intact, check intact and follow instructions on the AIFF. If VCBM is NOT present at the property, check item does not apply to this property.

Location dust sample NOT collected due to presence of visible vermiculite: As detailed in the RI dust sampling protocol dust samples will not be collected on levels of a structure where vermiculite is observed. Circle all the locations where vermiculite was observed. If vermiculite is observed, note the specific location in the area provided. If dust samples where not collected at this property, check item does not apply to this property.

Outdoor Sampling

Visible vermiculite in large use area: If vermiculite is visible in large use areas follow the instruction provided on the AIFF and check boxes as activities are performed.

If vermiculite is not visible in a large use area, check item does not apply to this property.

Additional Information

Any information concerning the presence of sources that are identified in the occupant/owner interview, any access issues (i.e., no access give to attic, no indoor access, no outdoor access, no access to collect soil sample, etc.) or sample collection issues.

Site-Specific Standard Operating Procedure for Soil Sample Collection

SOP No: CDM-LIBBY-05 Revision 1

Project: Libby Asbestos Remedial Investigation - Contaminant Screening Study (CSS)/Remedial Investigation (RI)

Project Number: 3282-137

Prepared by: Thomas E. Cook, Environmental Scientist — 4/3/02 Date

Dee A. Warren, Revision 1, Project Scientist — 4/17/03 Date

Approved by: _____ Project Manager — 5/7/03 Date

_____ Technical Reviewer — 5/7/03 Date

_____ QA Reviewer — 5/12/03 Date

_____ EPA Approval — 5/19/03 Date

Section 1
Purpose

The purpose of this standard operating procedure (SOP) is to provide a standardized method for surface soil sampling to be used by employees of EPA Region VIII contractors/subcontractors supporting EPA Region VIII CSS and RI activities for the Libby Asbestos Project in Libby, Montana. This SOP describes the equipment and operations used for sampling surface soils in residential areas, which will be submitted for the analysis of Libby amphiboles. The EPA Region VIII remedial project manager, or on-scene coordinator must approve site-specific deviations from the procedures outlined in this document prior to initiation of the sampling activity. This SOP provides the protocols for composite surface-soil sampling.

Section 2
Responsibilities

Successful execution of the sampling and analysis plan (SAP) requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role.

The CSS/RI task leader is responsible for overseeing the CSS/RI residential surface soil sampling activities. The CSS/RI task leader is also responsible for checking all work performed and verifying that the work satisfies the specific tasks outlined by this SOP and the SAP. It is the responsibility of the CSS/RI task leader to communicate with the field personnel specific collection objectives and anticipate situations that require any deviation from the SAP. It is also the responsibility of the CSS/RI task leader to communicate the need for any deviations from the SAP with the appropriate EPA Region VIII personnel (remedial project manager or on-scene coordinator).

Field personnel performing soil sampling are responsible for adhering to the applicable tasks outlined in this procedure while collecting samples at residences. The field personnel should have limited discretion with regard to collection procedures but should exercise judgment regarding the exact location of the sample point, within the boundaries outlined by the CSS/RI task leader.

Section 3
Equipment

- Sample container - The sample container will consist of quart-sized zip-top plastic bags (2 per sample).
- Trowel - For collecting surface soil samples.
- Bulb planter - For collecting surface soil samples.
- Shovel - For collecting surface soil samples.
- Stainless steel mixing bowl - Used to mix and homogenize composite soil samples after collection.
- Gloves - For personal protection and to prevent cross-contamination of samples. May be plastic or latex. Disposable, powderless.
- Field clothing and personal protective equipment (PPE) - As specified in the health and safety plan (HASP).
- Field sprayers - For decontaminating nondisposable sampling equipment between samples will be used.
- Silica sand - For field equipment blank quality control (QC) samples.
- Wipes - Disposable, paper. Used to clean and decontaminate sampling equipment.
- Field logbook -Used to record progress of sampling effort and record any problems and field observations.

- Information Field Forms (IFF) - Used to record information such as property detail, location of amphibole contamination, and estimated quantities.
- Field Sample Data Sheet (FSDS) - Used to record soil sample information.
- Permanent marking pen - Used to label sample containers.
- Index ID stickers - Used to label sample containers.
- Plastic buckets - Used to wash nondisposable field equipment between samples.
- Trash bag - Used to dispose gloves and wipes.
- Cooler - Used to store samples while in the field.
- Chain of Custody Record - For ensuring custody of samples until shipping.
- Custody Seals - For ensuring custody of samples during shipping.

Section 4
Sampling Pattern

Each property will be segregated into land use areas for sampling purposes. Use areas may include but not be limited to:

- Yard (grassy area)
- Landscaped area
- Garden
- Fill area
- Driveway

Properties with grassy areas greater than ½ acre in size will be sectioned off into separate zones for increased accuracy in characterization. Sectioning properties into additional zones will be at the discretion of the CDM field team leader but consistent among the teams. This segregation will be accomplished so that a five-point composite sample will characterize the section. A five-point composite sample will be collected for land areas less than or equal to 1/8 of an acre.

Up to five composite soil samples will be collected at each property. Composite sampling requires soil collection from multiple (sub-sample) points. Composite samples will be collected from similar land use areas (i.e., yard, garden, stockpiled soil, etc.). Additional composite or grab samples may be collected dependent upon site conditions (i.e., multiple land use areas, zones, etc.). Conversely, not all land areas previously mentioned will be applicable at every property and fewer (not less than two) will be collected.

For non-disturbed areas (i.e., yard), composite samples will be collected from 0 to 1 inch (in.). For disturbed areas (i.e., driveway garden, fill area, landscaped areas, etc.), composite samples will be collected from 0 to 6 in. All composite soils samples will have five subsamples (i.e., five-point composite sample) of approximately equal size.

If vermiculite is observed in large land use areas (driveway and yards), one sample should be collected from each area. Any other land use areas where vermiculite product is visible will not be sampled. Instead, the location will be recorded in the field logbook and on the IFF.

Section 5
Sample Collection

Don the appropriate PPE as specified in the HASP. A new pair of plastic gloves are to be worn for each sample collected. Segregate land use areas on the property as described in Section 4. Visually inspect each land use area for visual vermiculite product. To reduce dust generation during sampling, use a sprayer with deionized water to wet each sample point prior to collection. Use the trowel to check beneath the surface soil layer, but do not advance more than 6 in. If visible vermiculite is observed, record information in the appropriate field forms and do not collect a sample from that land use area. If visible vermiculite is not observed, proceed with sample collection.

Within each land use area, select five subsample locations equidistant from each other. These five subsample locations will comprise the five-point composite sample for that land use area. All composite subsamples will originate from the same land use area. For example, do not mix subsamples from garden areas with subsamples from grassy areas.

Clean the subsample locations of twigs, leaves, and other vegetative material that can be easily removed by hand. Using the trowel, excavate a hole in the soil approximately 2 in. in diameter and 1 in. deep (6 in. for disturbed areas) while placing the excavated material directly inside the mixing bowl. The sides of the excavated hole should be close to vertical to avoid sampling that is biased in favor of the upper layer of soil. Repeat this step for each subsequent subsample until the appropriate number of composite subsamples has been collected.

Homogenize the sample using the sampling trowel. Once the sample is homogenized, fill the zip-top plastic bag to 1/3rd full (approximately 2000 grams). Affix the sample index identification (ID) sticker to the inside of the bag and write the index ID number on the outside of the bag. Double bag the sample and repeat the labeling process for the outer bag. Decontaminate equipment between composite samples as described in Section 8.

Repeat steps outlined above until all samples from a property have been collected.

Soil field duplicate samples will be collected at a rate of 1 per 20 (5 percent) of the field samples. Field duplicate samples will be collected as samples co-located in the same land use area. The duplicate will be collected from the same number of subsamples as the parent sample, but the subsample locations of the duplicate sample will be randomly located in the use area. These samples will be independently collected with separate sampling equipment. These samples will be used to determine the variability of sample results in a given land use are. These samples will not be used to determine variability in sampling techniques.

Section 6
Site Cleanup

Specific instruction regarding site cleanup of investigation-derived waste (IDW) is included in CDM SOP 2-2, Guide to Handling Investigation-Derived Waste, with modification. In general, replace soil plug with excess sample volume. The soil should be placed back into the hole and tamped down lightly. If sandy areas such as playgrounds are sampled, refilling the soil plug is not necessary.

Rinse water, the roots of vegetation removed during sampling, and any excess soil volume may be disposed of on the ground as specified in the SAP.

Section 7
Record Keeping and Quality Control

A field logbook should be maintained by each individual or team that is collecting samples as described in the SAP. The SAP will detail specific conditions (SOP 4-1), which require attention, but at a minimum the following information should be collected:

- Date
- Time
- Team members
- Weather conditions
- PPE used
- Locations of any samples and subsamples that could not be acquired
- Descriptions of any deviations to the SAP and the reason for the deviation

Complete the IFF and FSDS for each property/sample.

Quality control samples will include:

- Field duplicates
- Equipment blank samples

Detailed information on QC sample collection and frequency is included in the SAP.

Section 8
Decontamination

All sampling equipment must be decontaminated prior to reuse. Specific instructions on sample equipment decontamination are included in CDM SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites, with modification. In general, the procedure to decontaminate all equipment is outlined below:

Decontamination procedures for soil sampling equipment will follow these steps:

- Remove all gross contamination with plastic brush
- Use DI water and a plastic brush to wash each piece of equipment
- Remove excess water present on the equipment by shaking
- Use a paper towel to dry each piece of equipment
- Wrap dried equipment in aluminum foil

Once a week all soil sampling equipment will be cleaning using Alconox and DI water.

Spent wipes, gloves, and PPE must be disposed or stored properly as specified in the SAP.

Section 9
Glossary

Sampling and Analysis Plan (SAP) - The written document that spells out the detailed site-specific procedures to be followed by the project leader and the field personnel.

Sample Point - The actual location at which the sample is taken. The dimension of a sample point is 2 in. across by 1 in. deep (6 in. for disturbed areas).

Composite Sampling - A sample program in which multiple sample points are compiled together and submitted for analysis as a single sample.

Land Use Area - A section of property segregated by how the property owner uses the section. For example, garden landscaped areas are individual land use areas. Grassy areas (i.e., lawn) are also considered to be a separate land use area.

Appendix D
Libby Asbestos Project Record of Deviation/Record of Modification Form

Record of Deviation/ Request for Modification

to the

Libby Sampling and Quality Assurance Project Plan

Field Activities

Instructions to Requester: Fax to contacts at bottom of form for review and approval. File approved copy with Data Manager and fax copy to SRC.

Project QAPP (circle one): PE Study Part a (approved 6/00), b (approval pending), c (approval pending)
Phase I (approved 4/00) Phase II (approved 2/01)
Removal Action (approved 7/00) CSS (approval 5/02)

Scenario No. (circle one): 1 2 3 4 NA

Requester: _____ Title: _____
Company: _____ Date: _____

Description of Deviation:

_____
_____

Field Logbook and page number deviation is documented on: _____
Reason for Deviation:

_____
_____

Potential Implications of this Deviation:

_____
_____

Duration of Deviation (circle one):

Temporary Date(s): _____
Resident address(es): _____
_____

Permanent (complete Proposed Modification Section)

Proposed Modification to SQAPP (attach additional sheets if necessary; state section and page numbers of SQAPP when applicable):

_____
_____
_____

Technical Review: _____ Date: _____
(Volpe Project Manager or designate)

Quality Assurance Review and Approval: _____ Date: _____
(Quality Assurance Coordinator or designate)

Approved By: _____ Title: _____ Date: _____
(USEPA OSC or SSC)

Appendix E
ASTM Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Concentrations. Designation Method D5775-95

Designation: D 5755 – 95

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St. Philadelphia, Pa 19103
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If not listed in the current combined index, will appear in the next edition.

Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Concentrations[1]

This standard is issued under the fixed designation D 5755; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a procedure to (*a*) identify asbestos in dust and (*b*) provide an estimate of the concentration of asbestos in the sampled dust reported as the number of asbestos structures per unit area of sampled surface.

1.1.1 If an estimate of the asbestos mass is to be determined, the user is referred to Test Method D 5756.

1.2 This test method describes the equipment and procedures necessary for sampling, by a microvacuum technique, non-airborne dust for levels of asbestos structures. The non-airborne sample is collected inside a standard filter membrane cassette from the sampling of a surface area for dust which may contain asbestos.

1.2.1 This procedure uses a microvacuuming sampling technique. The collection efficiency of this technique is unknown and will vary among substrates. Properties influencing collection efficiency include surface texture, adhesiveness, electrostatic properties and other factors.

1.3 Asbestos identified by transmission electron microscopy (TEM) is based on morphology, selected area electron diffraction (SAED), and energy dispersive X-ray analysis (EDXA). Some information about structure size is also determined.

1.4 This test method is generally applicable for an estimate of the concentration of asbestos structures starting from approximately 1000 asbestos structures per square centimetre.

1.4.1 The procedure outlined in this test method employs an indirect sample preparation technique. It is intended to disperse aggregated asbestos into fundamental fibrils, fiber bundles, clusters, or matrices that can be more accurately quantified by transmission electron microscopy. However, as with all indirect sample preparation techniques, the asbestos observed for quantification may not represent the physical form of the asbestos as sampled. More specifically, the procedure described neither creates nor destroys asbestos, but it may alter the physical form of the mineral fibers.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1193 Specification for Reagent Water[2]

D 1739 Test Method for the Collection and Measurement of Dustfall (Settleable Particulate Matter)[3]

D 3195 Practice for Rotameter Calibration[3]

D 3670 Guide for Determination of Precision and Bias of Methods of Committee D-22[3]

D 5756 Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Mass Concentration[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *asbestiform*—a special type of fibrous habit in which the fibers are separable into thinner fibers and ultimately into fibrils. This habit accounts for greater flexibility and higher tensile strength than other habits of the same mineral. For more information on asbestiform mineralogy, see Refs (1),[4] (2) and (3).

3.1.2 *asbestos*—a collective term that describes a group of naturally occurring, inorganic, highly fibrous, silicate dominated minerals, which are easily separated into long, thin, flexible fibers when crushed or processed.

DISCUSSION—Included in the definition are the asbestiform varieties of: serpentine (chrysotile); riebeckite (crocidolite); grunerite (grunerite asbestos); anthophyllite (anthophyllite asbestos); tremolite (tremolite asbestos); and actinolite (actinolite asbestos). The amphibole mineral compositions are defined according to nomenclature of the International Mineralogical Association (3).

Asbestos	Chemical Abstract Service No.[5]
Chrysotile	12001-29-5
Crocidolite	12001-28-4
Grunerite Asbestos	12172-73-5
Anthophyllite Asbestos	77536-67-5
Tremolite Asbestos	77536-68-6
Actinolite Asbestos	77536-66-4

3.1.3 *fibril*—a single fiber that cannot be separated into

[1] This test method is under the jurisdiction of ASTM Committee D-22 on Sampling and Analysis of Atmospheres and is the direct responsibility of Subcommittee D22.07 on Sampling and Analysis of Asbestos.

Current edition approved August 15, 1995. Published October 1995.

[2] *Annual Book of ASTM Standards*, Vol 11.01.

[3] *Annual Book of ASTM Standards*, Vol 11.03.

[4] The boldface numbers in parentheses refer to the list of references at the end of this test method.

[5] The non-asbestiform variations of the minerals indicated in 5.1.3 have different Chemical Abstract Service (CAS) numbers.

smaller components without losing its fibrous properties or appearance.

3.2 *Descriptions of Terms Specific to This Standard:*

3.2.1 *aspect ratio*—the ratio of the length of a fibrous particle to its average width.

3.2.2 *bundle*—a structure composed of three or more fibers in a parallel arrangement with the fibers closer than one fiber diameter to each other.

3.2.3 *cluster*—a structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group; groupings of fibers must have more than two points touching.

3.2.4 *debris*—materials that are of an amount and size (particles greater than 1 mm in diameter) that can be visually identified as to their source.

3.2.5 *dust*—any material composed of particles in a size range of ≤1 mm and large enough to settle by virtue of their weight from the ambient air (see definition for settleable particulate matter in Test Method D 1739).

3.2.6 *fiber*—a structure having a minimum length of 0.5 μm, an aspect ratio of 5:1 or greater, and substantially parallel sides (4).

3.2.7 *fibrous*—of a mineral composed of parallel, radiating, or interlaced aggregates of fibers, from which the fibers are sometimes separable. That is, the crystalline aggregate may be referred to as fibrous even if it is not composed of separable fibers, but has that distinct appearance. The term fibrous is used in a general mineralogical way to describe aggregates of grains that crystallize in a needle-like habit and appear to be composed of fibers. Fibrous has a much more general meaning than asbestos. While it is correct that all asbestos minerals are fibrous, not all minerals having fibrous habits are asbestos.

3.2.8 *indirect preparation*—a method in which a sample passes through one or more intermediate steps prior to final filtration.

3.2.9 *matrix*—a structure in which one or more fibers, or fiber bundles that are touching, are attached to, or partially concealed by a single particle or connected group of nonfibrous particles. The exposed fiber must meet the fiber definition (see 3.2.6).

3.2.10 *structures*—a term that is used to categorize all the types of asbestos particles which are recorded during the analysis (such as fibers, bundles, clusters, and matrices). Final results of the test are always expressed in asbestos structures per square centimetre.

4. Summary of Test Method

4.1 The sample is collected by vacuuming a known surface area with a standard 25 or 37 mm air sampling cassette using a plastic tube that is attached to the inlet orifice which acts as a nozzle. The sample is transferred from inside the cassette to an aqueous solution of known volume. Aliquots of the suspension are then filtered through a membrane. A section of the membrane is prepared and transferred to a TEM grid using the direct transfer method. The asbestiform structures are identified, sized, and counted by TEM, using SAED and EDXA at a magnification of 15 000 to 20 000X.

5. Significance and Use

5.1 This microvacuum sampling and indirect analysis method is used for the general testing of non-airborne dust samples for asbestos. It is used to assist in the evaluation of dust that may be found on surfaces in buildings such as ceiling tiles, shelving, electrical components, duct work, carpet, etc. This test method provides an index of the concentration of asbestos structures in the dust per unit area analyzed as derived from a quantitative TEM analysis.

5.1.1 This test method does not describe procedures or techniques required to evaluate the safety or habitability of buildings with asbestos-containing materials, or compliance with federal, state, or local regulations or statutes. It is the user's responsibility to make these determinations.

5.1.2 At present, a single direct relationship between asbestos-containing dust and potential human exposure does not exist. Accordingly, the user should consider these data in relationship to other available information in their evaluation.

5.2 This test method uses the definition, settleable particulate material, found in Test Method D 1739 as the definition of dust. This definition accepts all particles small enough to pass through a 1 mm (No. 18) screen. Thus, a single, large asbestos containing particle(s) (from the large end of the particle size distribution) dispersed during sample preparation may result in anomalously large asbestos concentration results in the TEM analyses of that sample. It is, therefore, recommended that multiple independent samples are secured from the same area, and a minimum of three samples analyzed by the entire procedure.

6. Interferences

6.1 The following minerals have properties (that is, chemical or crystalline structure) which are very similar to asbestos minerals and may interfere with the analysis by causing a false positive to be recorded during the test. Therefore, literature references for these materials must be maintained in the laboratory for comparison to asbestos minerals so that they are not misidentified as asbestos minerals.

6.1.1 *Antigorite.*

6.1.2 *Palygorskite (Attapulgite).*

6.1.3 *Halloysite.*

6.1.4 *Pyroxenes.*

6.1.5 *Sepiolite.*

6.1.6 *Vermiculite scrolls.*

6.1.7 *Fibrous talc.*

6.1.8 Hornblende and other amphiboles other than those listed in 3.1.2.

6.2 Collecting any dust particles greater than 1 mm in size in this test method may cause an interference and, therefore, must be avoided.

7. Materials and Equipment

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without

lessening the accuracy of the determination.[6]

7.2 *Transmission Electron Microscope (TEM)*, an 80 to 120 kV TEM, capable of performing electron diffraction, with a fluorescent screen inscribed with calibrated gradations, is required. The TEM must be equipped with energy dispersive X-ray spectroscopy (EDXA) and it must have a scanning transmission electron microscopy (STEM) attachment or be capable of producing a spot size of less than 250 nm in diameter in crossover.

7.3 *Energy Dispersive X-ray System (EDXA).*

7.4 *High Vacuum Carbon Evaporator*, with rotating stage.

7.5 *High Efficiency Particulate Air (HEPA)*, filtered negative flow hood.

7.6 *Exhaust or Fume Hood.*

7.7 *Particle-free Water* (ASTM Type II, see Specification D 1193).

7.8 *Glass Beakers* (50 mL).

7.9 *Glass Sample Containers*, with wide mouth screw cap (200 mL) or equivalent sealable container (height of the glass sample container should be approximately 13 cm high by 6 cm wide).

7.10 *Waterproof Markers.*

7.11 *Forceps* (tweezers).

7.12 *Ultrasonic Bath*, table top model (100 W).

7.13 *Graduated Pipettes* (1, 5, 10 mL sizes), glass or plastic.

7.14 *Filter Funnel*, either 25 mm or 47 mm, glass or disposable. Filter funnel assemblies, either glass or disposable plastic, and using either a 25 mm or 47 mm diameter filter.

7.15 *Side Arm Filter Flask*, 1000 mL.

7.16 *Mixed Cellulose Ester (MCE) Membrane Filters*, 25 or 47 mm diameter, ≤0.22 µm and 5 µm pore size.

7.17 *Polycarbonate (PC) Filters*, 25 or 47 mm diameter, ≤0.2 µm pore size.

7.18 *Storage Containers*, for the 25 or 47 mm filters (for archiving).

7.19 *Glass Slides*, approximately 76 by 25 mm in size.

7.20 *Scalpel Blades*, No. 10, or equivalent.

7.21 *Cabinet-type Desiccator*, or low temperature drying oven.

7.22 *Chloroform*, reagent grade.

7.23 *Acetone*, reagent grade.

7.24 *Dimethylformamide (DMF).*

7.25 *Glacial Acetic Acid.*

7.26 *1-methyl-2-pyrrolidone.*

7.27 *Plasma Asher*, low temperature.

7.28 *pH Paper.*

7.29 *Air Sampling Pump*, low volume personal-type, capable of achieving a flow rate of 1 to 5 L/min.

7.30 *Rotameter.*

7.31 *Air Sampling Cassettes*, 25 mm or 37 mm, containing 0.8 µm or smaller pore size MCE or PC filters.

7.32 *Cork Borer*, 7 mm.

7.33 *Non-Asbestos Mineral*, references as outlined in 6.1.

7.34 *Asbestos Standards*, as outlined in 3.1.2.

7.35 *Tygon*[7] *Tubing*, or equivalent.

7.36 *Small Vacuum Pump*, that can maintain a pressure of 92 kPa.

7.37 *Petri Dishes*, large glass, approximately 90 mm in diameter.

7.38 *Jaffe Washer*, stainless steel or aluminum mesh screen, 30 to 40 mesh, and approximately 75 mm by 50 mm in size.

7.39 *Copper TEM Finder Grids*, 200 mesh.

7.40 *Carbon Evaporator Rods.*

7.41 *Lens Tissue.*

7.42 *Ashless Filter Paper Filters*, 90 mm diameter.

7.43 *Gummed Paper Reinforcement Rings.*

7.44 *Wash Bottles*, plastic.

7.45 *Reagent Alcohol*, HPLC Grade (Fisher A995 or equivalent).

7.46 *Opening Mesh Screen*, plastic, 1.0 by 1.0 mm, (Spectra-Mesh #146410 or equivalent).

7.47 *Diffraction Grating Replica.*

8. Sampling Procedure for Microvacuum Technique

8.1 For sampling asbestos-containing dust in either indoor or outdoor environments, commercially available cassettes must be used. Air monitoring cassettes containing 25 mm or 37 mm diameter mixed cellulose ester (MCE) or polycarbonate (PC) filter membranes with a pore size less than or equal to 0.8 µm are required (7.31). The number of samples collected depends upon the specific circumstances of the study.

8.2 Maintain a log of all pertinent sampling information and sampling locations.

8.3 Sampling pumps and flow indicators shall be calibrated using a certified standard apparatus or assembly (see Practice D 3195 and 7.29).

8.4 Record all calibration information (5).

8.5 Perform a leak check of the sampling system at each sampling site by activating the pump (7.29) with the closed sampling cassette in line. Any air flow shows that a leak is present that must be eliminated before initiating the sampling operation.

8.6 Attach the sampling cassette to the sampling pump at the outlet side of the cassette with plastic tubing (7.35). The plastic tubing must be long enough in that the sample areas can be reached without interference from the sampling pump. Attach a clean, approximately 25.4 mm long piece of plastic tubing (6.35 mm internal diameter) directly to the inlet orifice. Use this piece of tubing as the sampling nozzle. Cut the sampling end of the tubing at a 45° angle as illustrated in Fig. 1. The exact design of the nozzle is not critical as long as some vacuum break is provided to avoid simply pushing the dust around on the surface with the nozzle rather than vacuuming it into the cassette. The internal diameter of the nozzle and flow rate of the pump may vary as long as the air velocity is 100 (±10) cm/s. This air velocity calculation is based on an internal sampling tube diameter of 6.35 mm at a flow rate of 2 L/min.

8.7 Measure and determine the sample area of interest. A

[6] *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmaceutical Convention, Inc. (USPC), Rockville, MD.

[7] Tygon is a registered trademark of the DuPont Co.

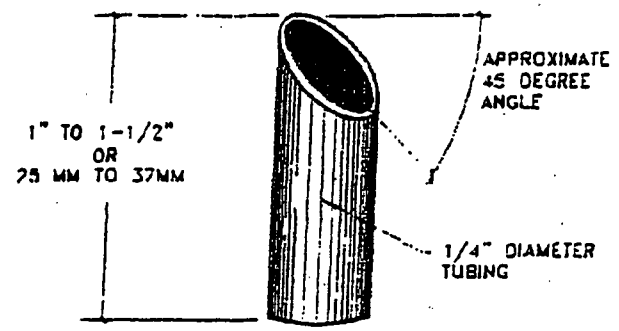

FIG. 1 Example of the Tubing Nozzle

sample area of 100 cm^2 is vacuumed until there is no visible dust or particulates matter remaining. Perform a minimum of two orthogonal passes on the surface within a minimum of 2 min of sampling time. Avoid scraping or abrading the surface being sampled. (Do not sample any debris or dust particles greater than 1 mm in diameter (see 4.2).) Smaller or larger areas can be sampled, if needed. For example, some surfaces of interest may have a smaller area than 100 cm^2. Less dusty surfaces may require vacuuming of larger areas. Unlike air samples, the overloading of the cassettes with dust will not be a problem. As defined in 3.2.5, only dust shall be collected for this analysis.

8.8 At the end of sample collection, invert the cassette so that the nozzle inlet faces up before shutting off the power to the pump. The nozzle is then sealed with a cassette end-plug and the cassette/nozzle taped or appropriately packaged to prevent separation of the nozzle and cassette assembly. A second option is the removal of the nozzle from the cassette, then plugging of the cassette and shipment of the nozzle (also plugged at both ends) sealed in a separate closeable plastic bag. A third option is placing the nozzle inside the cassette for shipment. The nozzle is always saved and rinsed because a significant percentage of the dust drawn from a lightly loaded surface may adhere to the inside walls of the tubing.

8.9 Check that all samples are clearly labeled, that all dust sampling information sheets are completed, and that all pertinent information has been enclosed, in accordance with laboratory quality control practices, before transfer of the samples to the laboratory. Include an unused cassette and nozzle as a field blank.

8.10 Wipe off the exterior surface of the cassettes with disposable wet towels (baby wipes) prior to packaging for shipment.

9. Sample Shipment

9.1 Ship dust samples to an analytical laboratory in a sealed container, but separate from any bulk or air samples. The cassettes must be tightly sealed and packed in a material free of fibers or dust to minimize the potential for contamination. Plastic "bubble pack" is probably the most appropriate material for this purpose.

10. Sample Preparation

10.1 Under a negative flow HEPA hood (7.5), carefully wet-wipe the exterior of the cassettes to remove any possible contamination before taking cassettes into a clean preparation area.

10.2 Perform sample preparation in a clean facility that has a separate work area from both the bulk and air sample preparation areas.

10.3 Initial specimen preparation shall take place in a clean HEPA filtered negative pressure hood to avoid any possible contamination of the laboratory or personnel, or both, by the potentially large number of asbestos structures in an asbestos-containing dust sample. Cleanliness of the preparation area hoods is measured by the cumulative process blank concentrations (see Section 11).

10.4 All sample preparation steps 10.4.1 through 10.4.6 shall take place in the dust preparation area inside a HEPA hood.

10.4.1 Remove the upper plug from the sample cassette and carefully introduce approximately 10 mL solution of a 50/50 mixture of particle-free water and reagent alcohol into the cassette using a plastic wash bottle (7.44). If the plugged nozzle was left attached to the cassette, then remove the plug and introduce the water/alcohol solution into the cassette through the tubing, and then remove the tubing, if it is visibly clean.

10.4.2 Replace the upper plug or the sample cap and lightly shake the dust suspension by hand for 3 s.

10.4.3 Remove the entire cap of the cassette and pour the suspension through a 1.0 by 1.0 mm opening screen (7.46) into a pre-cleaned 200 mL glass specimen bottle (7.9). All visible traces of the sample contained in the cassette shall be rinsed through the screen into the specimen bottle with a plastic wash bottle containing the 50/50 solution of particle-free water and alcohol. Repeat this procedure two additional times for a total of three washings. Next, rinse the nozzle two or three times through the screen into the specimen bottle with the 50/50 mixture of water and alcohol. Typically, the total amount of the 50/50 mixture used in the rinse is 50 to 75 mL. Discard the 1.0 by 1.0 mm screen and bring the volume of solution in the specimen bottle up to the 100 mL mark on the side of the bottle with particle-free water only.

10.4.4 Adjust the pH of the suspension to 3 to 4 using a 10.0 % solution of acetic acid. Use pH paper for testing. Filter the suspension within 24 h to avoid problems associated with bacterial and fungal growth.

10.4.5 Use either a disposable plastic filtration unit or a glass filtering unit (7.14) for filtration of aliquots of the suspension. The ability of an individual filtration unit to produce a uniform distribution may be tested by the filtration of a colored particulate suspension such as diluted India ink (suspension of carbon black).

10.4.5.1 If a disposable plastic filtration unit is used, then unwrap a new disposable plastic filter funnel unit (either 25 or 47 mm diameter) and remove the tape around the base of the funnel. Remove the funnel and discard the top filter supplied with the apparatus, retaining the coarse polypropylene support pad in place. Assemble the unit with the adapter and a properly sized neoprene stopper, and attach the funnel to the 1000 mL side-arm vacuum flask (7.15). Place a 5.0 µm pore size MCE (backing filter) on the support pad. Wet it with a few mL of particle-free water and place an MCE (7.16) or PC filter (≤0.22 µm pore size) (7.17) on top of the backing filter. Apply a vacuum (7.36), ensuring

that the filters are centered and pulled flat without air bubbles. Any irregularities on the filter surface requires the discard of that filter. After the filter has been seated properly, replace the funnel and reseal it with the tape. Return the flask to atmospheric pressure.

10.4.5.2 If a glass filtration unit is used, place a 5 µm pore size MCE (backing filter) on the glass frit surface. Wet the filter with particle-free water, and place an MCE or PC filter (≤0.22 µm pore size) on top of the backing filter. Apply a vacuum, ensuring that the filters are centered and pulled flat without air bubbles. Replace the filters if any irregularities are seen on the filter surface. Before filtration of each set of sample aliquots, prepare a blank filter by filtration of 50 mL of particle-free water. If aliquots of the same sample are filtered in order of increasing concentration, the glass filtration unit need not be washed between filtration. After completion of the filtration, do not allow the filtration funnel assembly to dry because contamination is then more difficult to remove. Wash any residual suspension from the filtration assembly by holding it under a flow of water, then rub the surface with a clean paper towel soaked in a detergent solution. Repeat the cleaning operation, and then rinse two times in particle-free water.

10.4.6 With the flask at atmospheric pressure, add 20 mL of particle-free water into the funnel. Cover the filter funnel with its plastic cover if the disposable filtering unit is used.

10.4.7 Briefly hand shake (3 s) the capped bottle with the sample suspension, then place it in a tabletop ultrasonic bath (7.12) and sonicate for 3.0 min. Maintain the water level in the sonicator at the same height as the solution in sample bottle. The ultrasonic bath shall be calibrated as described in 20.5. The ultrasonic bath must be operated at equilibrium temperature. After sonicating, return the sample bottle to the work surface of the HEPA hood. Preparation steps 10.4.8 through 10.4.14 shall be carried out in this hood.

10.4.8 Shake the suspension lightly by hand for 3 s, then let it rest for 2.0 min to allow large particles to settle to the bottom of the bottle or float to the surface.

10.4.9 Estimate the amount of liquid to be withdrawn to produce an adequate filter preparation. Experience has shown that a light staining of the filter surface will yield a suitable preparation for analysis. Filter at least 1.0 mL, but no more than half the total volume. If after examination in the TEM, the smallest volume measured (1.0 mL) (7.13) yields an overloaded sample, then perform additional serial dilutions of the suspension. If it is estimated that less than 1.0 mL of solution has to be filtered because of the density of the suspension, perform a serial dilution.

10.4.9.1 If serial dilutions are required, repeat step 10.4.8 before the serial dilution portion is taken. Do not re-sonicate the original solution or any serial dilutions. The recommended procedure for a serial dilution is to mix 10 mL of the sample solution with 90 mL of particle-free water in a clean sample bottle to obtain a 1:10 serial dilution. Follow good laboratory practices when performing dilutions.

10.4.10 Insert a new disposable pipette halfway into the sample suspension and withdraw a portion. Avoid pipetting any of the large floating or settled particles. Uncover the filter funnel and dispense the mixture from the pipette into the water in the funnel.

10.4.11 Apply vacuum to the flask and draw the mixture through the filter.

10.4.12 Discard the pipette.

10.4.13 Disassemble the filtering unit and carefully remove the sample filter with fine tweezers (7.11). Place the completed sample filter particle side up, into a precleaned, labeled, disposable, plastic petri dish (7.48) or other similar container.

10.4.14 In order to ensure that an optimally-loaded filter is obtained, it is recommended that filters be prepared from several different aliquots of the dust suspension. For this series of filters, it is recommended that the volume of each aliquot of the original suspension be a factor of five higher than the previous one. If the filters are prepared in order of increasing aliquot volume, all of the filters for one sample can be prepared using one plastic disposable filtration unit, or without cleaning of glass filtration equipment between individual filtration. Before withdrawal of each aliquot from the sample, shake the suspension without additional sonification and allow to rest for 2 min.

10.4.15 There are many practical methods for drying MCE filters. The following are two examples that can be used: (*1*) dry MCE filters for at least 12 h (over desiccant) in an airtight cabinet-type desiccator (7.21); (*2*) to shorten the drying time (if desired), remove a plug of the damp filter and attach it to a glass slide (7.19) as described in 12.1.2 and 12.1.3. Place the slide with a filter plug or filter plugs (up to eight plugs can be attached to one slide) on a bed of desiccant, in the desiccator for 1 h.

10.4.16 PC filters do not require lengthy drying before preparation, but shall be placed in a desiccator for at least 30 min before preparation.

10.5 Prepare TEM specimens from small sections of each dried filter using the appropriate direct transfer preparation method.

11. Blanks

11.1 Prepare sample blanks that include both a process blank (50 mL of particle-free water) for each set of samples analyzed and one unused filter from each new box of sample filters (MCE or PC) used in the laboratory. If glass filtering units are used, prepare and analyze a process blank each time the filtering unit is cleaned. Blanks will be considered contaminated, if after analysis, they are shown to contain more than 53 asbestos structures per square millimetre. This generally corresponds to three or four asbestos structures found in ten grid openings. The source of the contamination must be found before any further analysis can be performed. Reject samples that were processed along with the contaminated blanks and prepare new samples after the source of the contamination is found.

11.2 Prepare field blanks which are included with sample sets in the same manner as the samples, to test for contamination during the sampling, shipping, handling, and preparation steps of the method.

12. *TEM Specimen Preparation of Mixed Cellulose Ester (MCE) Filters*

NOTE 1—Use of either the acetone or the dimethylformamide-acetic acid method is acceptable.

12.1 *Acetone Fusing Method:*

12.1.1 Remove a section (a plug) from any quadrant of the sample and blank filters. Sections can be removed from the filters using a 7 mm cork borer (7.32). The cork borer must be wet wiped after each time a section is removed.

12.1.2 Place the filter section (particle side up) on a clean microscope slide. Affix the filter section to the slide with a gummed page reinforcement (7.43), or other suitable means. Label the slide with a glass scribing tool or permanent marker (7.10).

12.1.3 Prepare a fusing dish from a glass petri dish (7.37) and a metal screen bridge (7.38) with a pad of five to six ashless paper filters (7.42) and place in the bottom of the petri dish (4). Place the screen bridge on top of the pad and saturate the filter pads with acetone. Place the slide on top of the bridge in the petri dish and cover the dish. Wait approximately 5 min for the sample filter to fuse and clear.

12.2 *Dimethylformamide-Acetic Acid Method:*

12.2.1 Place a drop of clearing solution that consists of 35 % dimethylformamide (DMF), 15 % glacial acetic acid, and 50 % Type II water (v/v) on a clean microscope slide. Gauge the amount used so that the clearing solution just saturates the filter section.

12.2.2 Carefully lay the filter segment, sample surface upward, on top of the solution. Bring the filter and solution together at an angle of about 20° to help exclude air bubbles. Remove any excess clearing solution. Place the slide in an oven or on a hot plate, in a fume hood, at 65 to 70°C for 10 min.

12.3 Plasma etching of the collapsed filter is required.

12.3.1 The microscope slide to which the collapsed filter pieces are attached is placed in a plasma asher (7.27). Because plasma ashers vary greatly in their performance, both from unit to unit and between different positions in the asher chamber, it is difficult to specify the exact conditions that must be used. Insufficient etching will result in a failure to expose embedded fibers, and too much etching may result in the loss of particles from the filter surface. To determine the optimum time for ashing, place an unused 25 mm diameter MCE filter in the center of a glass microscope slide. Position the slide approximately in the center of the asher chamber. Close the chamber and evacuate to a pressure of approximately 40 Pa, while admitting oxygen to the chamber at a rate of 8 to 20 cm^3/min. Adjust the tuning of the system so that the intensity of the plasma is maximized. Determine the time required for complete oxidation of the filter. Adjust the system parameters to achieve complete oxidation of the filter in a period of approximately 15 min. For etching of collapsed filters, use these operating parameters for a period of 8 min. For additional information on calibration, see the *USEPA Asbestos-Containing Materials in Schools* (4) or *NIST/NVLAP Program Handbook for Airborne Asbestos Analysis* (6) documents.

12.3.2 Place the glass slide containing the collapsed filters into the low-temperature plasma asher, and etch the filter.

12.4 Carbon coating of the collapsed and etched filters is required.

12.4.1 Carbon coating must be performed with a high-vacuum coating unit (7.4), capable of less than 10^{-4} torr (13 MPa) pressure. Units that are based on evaporation of carbon filaments in a vacuum generated only by an oil rotary pump have not been evaluated for this application and shall not be used. Carbon rods (7.40) used for evaporators shall be sharpened with a carbon rod sharpener to a neck of about 4 mm in length and 1 mm in diameter. The rods are installed in the evaporator in such a manner that the points are approximately 100 to 120 mm from the surface of the microscope slide held in the rotating device.

12.4.2 Place the glass slide holding the filters on the rotation device, and evacuate the evaporator chamber to a vacuum of at least 13 MPa. Perform the evaporation in very short bursts, separated by 3 to 4 s to allow the electrodes to cool. An alternate method of evaporation is by using a slow continuous applied current. An experienced analyst can judge the thickness of the carbon film to be applied. Conduct tests on unused filters first. If the carbon film is too thin, large particles will be lost from the TEM specimen, and there will be few complete and undamaged grid openings on the specimen.

12.4.2.1 If the coating is too thick, it will lead to a TEM image that is lacking in contrast, and the ability to obtain electron diffraction patterns will be compromised. The carbon film shall be as thin as possible and still remain intact on most of the grid openings of the TEM specimen.

12.5 *Preparation of the Jaffe Washer*—The precise design of the Jaffe washer is not considered important, so any one of the published designs may be used (7, 8). One such washer consists of a simple stainless steel bridge contained in a glass petri dish.

12.5.1 Place several pieces of lens tissue (7.41) on the stainless steel bridge. The pieces of lens tissue shall be large enough to completely drape over the bridge and into the solvent. In a fume hood, fill the petri dish with acetone (or DMF) until the height of the solvent is brought up to contact the underside of the metal bridge as illustrated in Fig. 2.

12.6 *Placing the Specimens into the Jaffe Washer:*

12.6.1 Place the TEM grids (7.39) shiny side up on a piece of lens tissue or filter paper so that individual grids can be easily picked up with tweezers.

12.6.2 Prepare three grids from each sample.

12.6.2.1 Using a curved scalpel blade (7.20), excise at least two square (3 mm by 3 mm) pieces of the carbon-coated MCE filter from the glass slide.

12.6.2.2 Place the square filter piece carbon-side up on top of a TEM specimen grid.

12.6.2.3 Place the whole assembly (filter/grid) on the saturated lens tissue in the Jaffe washer.

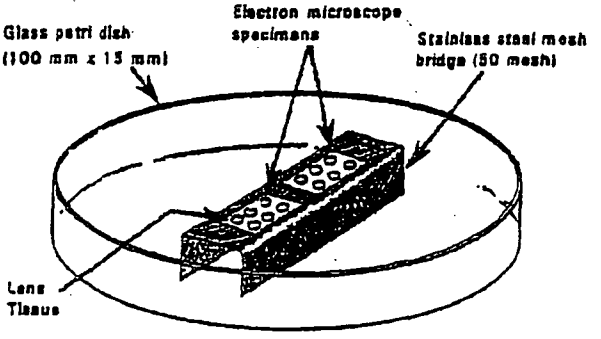

FIG. 2 Example of Design of Solvent Washer (Jaffe Washer)

12.6.2.4 Place the three TEM grid sample filter preparations on the same piece of lens tissue in the Jaffe washer.

12.6.2.5 Place the lid on the Jaffe washer and allow the system to stand for several hours.

12.7 Alternately, place the grids on a low level (petri dish filled to the ⅛ mark) DMF Jaffe washer for 60 min. Add enough solution of equal parts DMF/acetone to fill the washer to the screen level. Remove the grids after 30 min if they have cleared, that is, all filter material has been removed from the carbon film, as determined by inspection in the TEM.

12.8 Carefully remove the grids from the Jaffe washer, allowing the grids to dry before placing them in a clean marked grid box.

13. TEM Specimen Preparation of Polycarbonate (PC) Filter

13.1 Cover the surface of a clean microscope slide with two strips of double-sided adhesive tape.

13.2 Cut a strip of filter paper slightly narrower than the width of the slide. Position the filter paper strip on the center of the length of the slide.

13.3 Using a clean, curved scalpel blade, cut a strip of the PC filter approximately 25 by 6 mm. Use a rocking motion of the scalpel blade to avoid tearing the filter. Place the PC strip particle side up on the slide perpendicular to the long axis of the slide. The ends of the PC strip must contact the double sided adhesive tape. Each slide can hold several PC strips. With a glass marker, label each PC strip with the individual sample number.

13.4 Carbon coat the PC filter strips as discussed in 12.4.2. PC filters do not require etching.

NOTE 2: Caution—Do not overheat the filter sections while carbon coating.

13.5 Prepare a Jaffe washer as described in 12.5, but fill the washer with chloroform or 1-methyl-2-pyrrolidone to the level of the screen.

13.6 Using a clean curved scalpel blade, excise three, 3-mm square filter pieces from each PC strip. Place the filter squares carbon side up on the shiny side of a TEM grid. Pick up the grid and filter section together and place them on the lens tissue in the Jaffe washer.

13.7 Place the lid on the Jaffe washer and rest the grids in place for at least 4 h. Best results are obtained with longer wicking times, up to 12 h.

13.8 Carefully remove the grids from the Jaffe washer, allowing the grids to dry before placing them in a clean, marked grid box.

14. Grid Opening Measurements

14.1 TEM grids must have a known grid opening area. Determine this area as follows:

14.2 Measure at least 20 grid openings in each of 20 random 75 to 100 μm (200-mesh) copper grids for a total of 400 grid openings for every 1000 grids used, by placing the 20 grids on a glass slide and examining them under the optical microscope. Use a calibrated graticule to measure the average length and width of the 20 openings from each of the individual grids. From the accumulated data, calculate the average grid opening area of the 400 openings.

14.3 Grid area measurements can also be made at the TEM at a calibrated screen magnification of between 15 000 and 20 000X. Typically measure one grid opening for each grid examined. Measure grid openings in both the x and y directions and calculate the area.

14.4 Pre-calibrated TEM grids are also acceptable for this test method.

15. TEM Method

15.1 Microscope settings: 80 to 120 kV, 15 000 to 20 000X screen magnification for analysis (7.2).

15.2 Analyze two grids for each sample. Analyze one-half of the sample area on one sample grid preparation and the remaining half on a second sample grid preparation.

15.3 *Determination of Specimen Suitability:*

15.3.1 Carefully load the TEM grid, carbon side facing up (in the TEM column) with the grid bars oriented parallel/perpendicular to the length of the specimen holder. Use a hand lens or loupe, if necessary. This procedure will line up the grid with the X and y translation directions of the microscope. Insert the specimen holder into the microscope.

15.3.2 Scan the entire grid at low magnification (250X to 1000X) to determine its suitability for high magnification analysis as specified in 15.3.3.

15.3.3 Grids are acceptable for analysis if the following conditions are met:

15.3.3.1 The fraction of grid openings covered by the replica section is at least 50 %.

15.3.3.2 Relative to that section of the grid covered by the carbon replica, the fraction of intact grid openings is greater than 50 %.

15.3.3.3 The fractional area of undissolved filter is less than 10 %.

15.3.3.4 The fraction of grid openings with overlapping or folded replica film is less than 50 %.

15.3.3.5 At least 20 grid openings, that have no overlapping or folded replica, are less than 5 % covered with holes and have less than 5 % opaque area due to incomplete filter dissolution.

15.4 *Determination of Grid Opening Suitability:*

15.4.1 If the grid meets acceptance criteria, choose a grid opening for analysis from various areas of the grid so that the entire grid is represented. Determine the suitability of each individual grid opening prior to the analysis.

15.4.2 The individual grid opening must have less than 5 % holes over its area.

15.4.3 Grid openings must be less than 25 % covered with particulate matter.

15.4.4 Grid openings must be uniformly loaded.

15.5 Observe and record the orientation of the grid at 80 to 150X, on a grid map record sheet along with the location of the grid openings that are examined for the analysis. If indexed grids are used, a grid map is not required, but the identifying coordinates of the grid square must be recorded.

16. Recording Data Rules

16.1 Record on the count sheet any continuous grouping of particles in which an asbestos fiber is detected. Classify asbestos structures as fibers, bundles, clusters, or matrices as defined in 5.2.

16.2 Use the criteria for fiber, bundle, cluster, and matrix identification, as described in the *USEPA Asbestos-Containing*

Materials in Schools document (4). Record, for each AHERA structure identified, the length and width measurements.

16.3 Record NSD (No Structures Detected) when no structures are detected in the grid opening.

16.4 Identify structures classified as chrysotile identified by either electron diffraction or X-ray analysis (7.3) and recorded on a count sheet. Verify at least one out of every ten chrysotile structures by X-ray analysis.

16.5 Structures classified as amphiboles by X-ray analysis and electron diffraction are recorded on the count sheet. For more information on identification, see Yamate, et al, (7) or Chatfield and Dillon (8).

16.6 Record a typical electron diffraction pattern for each type of asbestos observed for each group of samples (or a minimum of every five samples) analyzed. Record the micrograph number on the count sheet. Record at least one X-ray spectrum for each type of asbestos observed per sample. Attach the print-outs to the back of the count sheet. If the X-ray spectrum is stored, record the file and disk number on the count sheet.

16.7 *Counting Rules:*

16.7.1 At a screen magnification of between 15 000 and 20 000X evaluate the grids for the most concentrated sample loading; reject the sample if it is estimated to contain more than 50 asbestos structures per grid opening. Proceed to the next lower concentrated sample until a set of grids are obtained that have less than 30 asbestos structures per grid opening.

16.8 *Analytical Sensitivity*—An analytical sensitivity of approximately 1000 asbestos structures per square centimetre (calculated for the detection of a single asbestos structure) has been designed for this analysis. This sensitivity can be achieved by increasing the amount of liquid filtered, increasing the number of grid openings analyzed, or decreasing the size of the final filter. Occasionally, due to high particle loadings or high asbestos concentration, this analytical sensitivity cannot be practically achieved and stopping rules apply.

16.9 *Limit of Detection*—The limit of detection for this method is defined as, at a minimum, the counting of four asbestos structures during the TEM analysis. If less than four asbestos structures are counted during the analysis then the analytical result which will be reported will be less than the limit of detection and a "less than" sign (<) will appear before the number. All data shall be provided in the laboratory report.

16.10 *Stopping Rules:*

16.10.1 The analysis is stopped upon the completion of the grid square that achieves an analytical sensitivity of less than 1000 asbestos structures per square centimetre.

16.10.2 If an analytical sensitivity of 1000 asbestos structures per square centimetre cannot be achieved after analyzing ten grid openings then stop on grid opening No. 10 or the grid opening which contains the 100th asbestos structure, whichever comes first. A minimum of four grid squares shall be analyzed for each sample.

16.10.2.1 If the analysis is stopped because of the 100th structure rule, the entire grid square containing the 100th structure must be counted.

16.11 After analysis, remove the grids from the TEM, and replace them in the appropriate grid storage holder.

17. Sample Storage

17.1 The washed-out sample cassettes can be discarded after use.

17.2 Sample grids and unused filter sections (7.18) must be stored for a minimum of one year.

18. Reporting

18.1 Report the following information for each dust sample analyzed:

18.1.1 Concentration in structures/cm^2.

18.1.2 The analytical sensitivity.

18.1.3 Types of asbestos present.

18.1.4 Number of asbestos structures counted.

18.1.5 Effective filtration area.

18.1.6 Average size of the TEM grid openings that were counted.

18.1.7 Number of grid openings examined.

18.1.8 Sample dilution used.

18.1.9 Area of the surface sampled.

18.1.10 Listing of size data for each structure counted.

18.1.11 A copy of the TEM count sheet or a complete listing of the raw data. An example of a typical count sheet is shown in Appendix X1.

18.2 Determine the amount of asbestos in any accepted sample using the following formula:

$$\frac{EFA \times 100\ \text{mL} \times \#STR}{GO \times GOA \times V \times SPL} = \text{asbestos structures/cm}^2 \quad (1)$$

where:

$\#STR$ = number of asbestos structures counted,
EFA = effective filter area of the final sampling filter, mm^2,
GO = number of grid openings counted,
GOA = average grid opening area, mm^2,
SPL = surface area sampled, cm^2, and
V = volume of sample filtered in step 10.4.9, representing the actual volume taken from the original 100 mL suspension, mL.

19. Quality Control/Quality Assurance

19.1 In general, the laboratory's quality control checks are used to verify that a system is performing according to specifications regarding accuracy and consistency. In an analytical laboratory, spiked or known quantitative samples are normally used. However, due to the difficulties in preparing known quantitative asbestos samples, routine quality control testing focuses on re-analysis of samples (duplicate recounts).

19.1.1 Re-analyze samples at a rate of 1/10 of the sample sets (one out of every ten samples analyzed not including laboratory blanks). The re-analysis shall consist of a second sample preparation obtained from the final filter.

19.2 In addition, quality assurance programs must follow the criteria shown in the *USEPA Asbestos-Containing Materials in Schools* document (4) and in the *NIST/NVLAP Program Handbook for Airborne Asbestos Analysis* document (6). These documents describe sample custody, sample preparation, blank checks for contamination, calibration, sample analysis, analyst qualifications, and technical facilities.

20. Calibrations

20.1 Perform calibrations of the instrumentation on a

regular basis, and retain these records in the laboratory, in accordance with the laboratory's quality assurance program.

20.2 Record calibrations in a log book along with dates of calibration and the attached backup documentation.

20.3 A calibration list for the instrument is as follows:

20.3.1 *TEM:*

20.3.1.1 Check the alignment and the systems operation. Refer to the TEM manufacturer's operational manual for detailed instructions.

20.3.1.2 Calibrate the camera length of the TEM in electron diffraction (ED) operating mode before ED patterns of unknown samples are observed. Camera length can be measured by using a carbon coated grid on which a thin film of gold has been sputtered or evaporated. A thin film of gold is evaporated on the specimen TEM grid to obtain zone-axis ED patterns superimposed with a ring pattern from the polycrystalline gold film. In practice, it is desirable to optimize the thickness of the gold film so that only one or two sharp rings are obtained on the superimposed ED pattern. Thick gold films will tend to mask weak diffraction spots from the fibrous particles. Since the unknown d-spacings of most interest in asbestos analysis are those which lie closest to the transmitted beam, multiple gold rings from thick films are unnecessary. Alternatively, a gold standard specimen can be used to obtain an average camera constant calculated for that particular instrument and can then be used for ED patterns of unknowns taken during the corresponding period.

20.3.1.3 Perform magnification calibration at the fluorescent screen. This calibration must be performed at the magnification used for structure counting. Calibration is performed with a grating replica (7.47) (for example, one containing at least 2160 lines/mm).

(*a*) Define a field of view on the fluorescent screen. The field of view must be measurable or previously inscribed with a scale or concentric circles (all scales should be metric).

(*b*) Frequency of calibration will depend on the service history of the particular microscope.

(*c*) Check the calibration after any maintenance of the microscope that involves adjustment of the power supply to the lens or the high voltage system or the mechanical disassembly of the electron optical column (apart from filament exchange).

(*d*) The analyst must ensure that the grating replica is placed at the same distance from the objective lens as the specimen.

(*e*) For instruments that incorporate a eucentric tilting specimen stage, all specimens and the grating replica must be placed at the eucentric position.

20.3.1.4 The smallest spot size of the TEM must be checked.

(*a*) At the crossover point, photograph the spot size at a screen magnification of 15 000 to 20 000X. An exposure time of 1 s is usually adequate.

(*b*) The measured spot size must be less than or equal to 250 nm.

20.4 *EDXA:*

20.4.1 The resolution and calibration of the EDXA must be verified.

20.4.1.1 Collect a standard EDXA Cu peak from the Cu grid.

20.4.1.2 Compare the X-ray energy versus channel number for the Cu peak and be certain that readings are within ±10 eV.

20.4.2 Collect a standard EDXA of crocidolite asbestos (NIST SRM 1866).

20.4.2.1 The elemental analysis of the crocidolite must resolve the Na peak.

20.4.3 Collect a standard EDXA of chrysotile asbestos.

20.4.3.1 The elemental analysis of chrysotile must resolve both Si and Mg on a single chrysotile fiber.

20.5 Ultrasonic bath calibration shall be performed as follows:

20.5.1 Fill the bath water to a level equal to the height of suspension in the glass sample container that will be used for the dust analysis. Operate the bath until the water reaches the equilibrium temperature.

20.5.2 Place 100 mL of water (at approximately 20°C) in another 200-mL glass sample container, and record its temperature.

20.5.3 Place the sample container in the water in the ultrasonic bath (with the power turned off). After 60 s, remove the glass container and record its temperature.

20.5.4 Place 100 mL of water (at approximately 20°C) in another 200-mL glass sample container, and record its temperature.

20.5.5 Place the second sample container into the water in the ultrasonic bath (with the power turned on). After 60 s, remove the glass container and record its temperature.

20.5.6 Calculate the rate of energy deposition into the sample container using the following formula:

$$R = 4.185 \times \sigma \times \rho \times \frac{(\theta_2 - \theta_1)}{t} \qquad (2)$$

where:

4.185 = Joules/cal,

R = energy deposition, watts/mL,

θ_1 = temperature rise with the ultrasonic bath not operating, °C,

θ_2 = temperature rise with the ultrasonic bath operating, °C,

t = time in seconds, 60 s (20.5.3 and 20.5.5),

σ = specific heat of the liquid in the glass sample container, 1.0 cal/g, and

ρ = density of the liquid in the glass sample container, 1.0 g/cm^3.

20.5.7 Adjust the operating conditions of the bath so that the rate of energy deposition is in the range of 0.08 to 0.12 MW/m^3, as defined by this procedure.

21. Precision and Bias

21.1 *Precision*—The precision of the procedure in this test method is being determined using round robin data from participating laboratories.

21.2 *Bias*—Since there is no accepted reference material suitable for determining the bias of the procedure in this test method, bias has not been determined (see Specification D 3670).

NOTE 3—Round robin data is under development and will be presented as a research report.

22. Keywords

22.1 asbestos; microvacuuming; settled dust; TEM

APPENDIX

(Nonmandatory Information)

X1. DUST SAMPLE ANALYSIS

X1.1 See Figs. X1.1 and X1.2 for the dust analysis worksheet and the TEM count sheet.

DUST SAMPLE ANALYSIS

Client:		Accelerating Voltage:	
Sample ID:		Indicated Mag:	KX
Job Number:		Screen Mag:	KX
Date Sample Analyzed:	- -	Microscope:	1 2 3 4 5
Number of Openings/Grids Counted:		Filter Type:	
Grid Accepted, 600X:	Yes No	Filter Size:	
Percent Loading:	%	Filter Pore Size (μm):	
Grid Box #1:		Grid Opening:	1) μm x μm
			2) μm x μm

Analyst: _____

Reviewer: _____ Counting Rules: AHERA LEVEL II

Calculation Data:

Effective Filter Area in mm^2:	(EFA)	
Number of Grid Openings Counted:	(GO)	
Avderage Grid Opening Area in mm^2:	(GOA)	
Volume of sample Filtered in ml:	(V)	
Surface area Sampled in cm^2:	(SPL)	
Number of Asbestos Structures Counted:*	(#STR)	

* If the number of asbestos structures counted is less than or equal to 4, enter 4 structures as the limit of detection here.

FORMULA FOR CALCULATION OF ASBESTOS STRUCTURES "DUST" PER CM^2:

$$\frac{EFAX \times 100 \times \#STR}{GO \times GOA \times VX SPL} = \text{(Asbestos Structures per } cm^2\text{)}$$

Results for Total Asbestos Structures: _____
(Structures per cm^2)

Results for Structures ≥ microns: _____
(Structures per cm^2)

FIG. X1.1 Dust Sample Analysis Work Sheet

Job Number: ______________________

Structure #	Grid # Square #	Type	Structure	Length Microns	Width Microns	Confirmation		
						Morph.	SAED	EDS

Note: Keys to Abbreviations Used in Figure:

Type:

C = Chrysotile
AM = Amosite
CR = Crocidolite
AC = Actinolite
TR = Tremolite
AN = Anthophyllite
N = Non Asbestos

Structure:

F = Fiber
B = Bundle
C = Cluster
M = Matrix

Others:

NSD = No Structures Detected
Morph = Morphology
SAED = Selected Area Electron Diffraction
EDS = Energy Dispersive X-Ray Spectroscopy
ER = Inter-Row Spacing
NP = No Pattern

FIG. X1.2 TEM Count Sheet

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Appendix F
EPA May 2002 Action Memorandum Amendment

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
999 18TH STREET - SUITE 500
DENVER, CO 80202-2466

LIBBY #2

Ref: 8EPR-ER

ACTION MEMORANDUM AMENDMENT

SUBJECT: Action Memorandum Amendment for the Time-Critical Removal Action at the **Libby Asbestos Site** - Libby, Lincoln County, Montana.

FROM: Jack W. McGraw
Acting Regional Administrator

TO: Marianne Lamont Horinko
Assistant Administrator
Office of Solid Waste and Emergency Response

THROUGH: Michael B. Cook, Director
Office of Emergency and Remedial Response

Site ID#: BC

Category of Removal: Time Critical, Non-NPL, EPA Fund-Lead

I. INTRODUCTION

The purpose of this ACTION MEMORANDUM AMENDMENT is to: 1) request and document Headquarters approval of a ceiling increase for the Libby Asbestos Site (Site) in the Libby Valley in Lincoln County, Montana; and 2) modify and expand the scope of the Removal Action described herein. The proposed modification of the scope of the Removal Action would address newly identified exposure pathways and sources of vermiculite contaminated with amphibole asbestos at the Site.

Although the EPA is further investigating a number scientific and legal issues, there is a clear concern for the health of the citizens of Libby. Therefore, it is proposed that the EPA proceed on all of the cleanup activities planned or underway, according to this Action Memorandum Amendment. This is to include the removal of vermiculite insulation from businesses and residences as necessary to assure the community's health is protected. For this reason, and as a result of the urgency to begin this Removal Action, this Action memorandum Amendment requests that, through your signature, you grant immediate authorization to the Region to proceed with these cleanup activities pending the final resolution of the scientific and legal issues mentioned above.

This Action Memorandum Amendment changes the scope of the Removal Action to address additional sources of amphibole asbestos where significant exposure may still take place. This action is based upon the unique circumstances in Libby, which include not only the level of cumulative exposure and multiple pathways, but also the highly unusual facts indicating that homes in Libby contain insulation that consists of the asbestos-containing vermiculite mined at Libby that was not inspected, packaged, labeled, warranted, regulated or sold as a commercial product.

II. SITE CONDITIONS AND BACKGROUND

A. Site Description

1. Removal Site Evaluation

The Action Memorandum dated May 23, 2000 (see Attachment 1) provides the basic description of the mine and processing facilities, and outlines EPA's initial Removal Actions at two industrial locations related to the Site. EPA approved the first Amendment to the Action Memorandum on August 17, 2001 (see Attachment 2), to continue the previous activities and address contamination at new properties.

The amphibole asbestos contamination found in the Libby Valley comes from one or some combination of the following sources:

Source	Description
Vermiculite Mining Wastes	Contaminated tailings and mine overburden. Used as fill material at locations throughout Libby. Samples indicate levels as high as 80% asbestos, with typical values between 3 to 12%.
Vermiculite Ores	Often mixed in garden soil or in bulk piles in yards. Material ranges from trace to 12% asbestos, with typical values between 3 to 8%.
Vermiculite Processing Wastes	Two waste streams from the vermiculite expansion plants: 1) Stoner rock is a grey-white, flaky crusted reject material. Handling can easily generate high levels of airborne asbestos fibers. Asbestos levels often reach as high as 35%. 2) Low-grade expanded vermiculite that contains a high percentage of unexpanded material. Some Libby residents have reported using this material on their properties.
Bulk Processing Residuals	Remnant materials around former processing plants and the rail corridor through Libby. Used as fill, or found in bulk piles. Usually similar in appearance and asbestos content to the wastes described above.

Tremolite Rocks	Small rocks to large boulders of amphibole asbestos, often mixed with vermiculite. Asbestos content can be as high as 80% to nearly 100%.
Vermiculite Insulation	Preliminary analysis shows that most of the vermiculite insulation found in homes and buildings in Libby contains amphibole asbestos. This material is potentially friable (i.e., it tends to generate airborne, respirable asbestos fibers), and may be resistant to encapsulation and coating techniques. EPA has concluded that Libby residents are a sensitive population. Asbestos exposures which would present acceptable risks to a healthy population may cause an increase in disease for this highly impacted community.
Amphibole Asbestos Dust	Contaminated dust inside the homes and businesses. EPA has collected 261 settled dust samples from 111 residential and/or business properties. 25% of these properties (13% of the samples collected) identified amphibole asbestos fibers greater than 5 um in length, at levels up to 300 times above the AHERA standard. This contamination is easily re-suspended in the air during routine cleaning activities.
Airborne or Ambient Amphibole Asbestos Fibers	Media reports suggest that the dry milling operation released up to 5000 lbs./day of asbestos during peak production (Seattle Post-Intelligencer, November 1999). Environmental releases likely contribute to contamination throughout the Libby Valley, including asbestos dust found in homes where no obvious source has been identified.

EPA site investigations have identified additional exposure pathways and contaminated properties. In addition to these removal activities, the Agency proposed the Site for inclusion on the NPL on February 26, 2002, at the request of the governor.

EPA studies indicate that the amphibole asbestos in vermiculite source materials may contribute to releases and threatened releases of contamination. Therefore, this Action Memorandum Amendment changes the scope of the Removal Action to address additional sources of amphibole asbestos where past, current or future exposure may take place. This approach is necessary because EPA and ATSDR investigations indicate that people in Libby have been exposed to amphibole asbestos via multiple pathways, and that cumulative exposures likely contribute to the observed asbestos-related health effects. The continued exposure of this population to any single amphibole asbestos release may further impact their health.

2. Physical Location/Site Characteristics.

The Libby Asbestos Site and its characteristics are defined in the previous Action Memoranda (Attachments 1 and 2). In general, EPA studies show that the nature of the contaminated areas that require response has shifted from a few large parcels with high volumes of contamination, to many smaller parcels with smaller amounts of contamination. Hence, the

physical descriptions will broadly address the homes and buildings found in the Libby Valley.

Homes and Businesses within the Libby City limits: homes within the City of Libby tend to be older (constructed prior to 1950), smaller (<1500 ft^2), and on smaller lots (<1/4 acre). There are roughly 600 homes within the city limits. Because of their age, and the harsh winter conditions in this part of Montana, the homes tend to require a higher level of maintenance work than most homes across the country. The homes typically remain tightly shut during the winter season, due to the local climate.

Most of the businesses in the City of Libby are clustered in the downtown area, along California and Mineral Avenues, and along the Highway 2 corridor. The downtown businesses are commonly laid out in adjoining "row house style," and may share a common wall or roof. Most buildings in this corridor are one or two stories. There are some stand-alone buildings, as well as a few out buildings. The majority of these buildings were constructed prior to 1950.

The businesses along the Highway 2 corridor are almost all stand alone properties, with a few strip mall developments. Most of these buildings are of single story construction, and more recently built than the downtown businesses.

There are two large commercial operations within the city limits of Libby. The Burlington-Northern Railroad (BNR) rail yard straddles Highway 37 where it crosses the Kootenai River. BNR investigations identified amphibole asbestos contamination along the tracks in the rail yard, and in the buildings. BNR has begun to address these issues by removing the contaminated source materials from its property.

The other large commercial operation is the Stimson Lumber Mill. The mill currently manufactures plywood and dimension lumber. Prior to 1950, this site housed vermiculite processing operations. In addition, a portion of this property was used as a tree nursery, which used various grades of Libby vermiculite ores in bulk. Several of the buildings on the Mill property also contain varying amounts of vermiculite. The EPA and Stimson are currently investigating the contamination associated with these former operations, and monitoring the exposure of Stimson workers to amphibole asbestos.

3. Release or threatened release into the environment of a hazardous substance, or pollutant or contaminant.

The amphibole asbestos discussed in this Action Memorandum Amendment is a hazardous substance as defined by Section 101 of CERCLA. EPA sampling and investigation have identified amphibole asbestos contamination at all of the locations found within the Libby Asbestos Site that are the subject of this and previous Removal Actions. EPA believes that asbestos contamination is tracked into homes from the environment and out of homes into the environment from various sources.

4. NPL status

In January 2002, the Governor of Montana designated the Site as the State's highest priority for cleanup, and requested that as such the Site be included on the NPL per 40 CFR 300.425(c)(2). EPA proposed the Site to the NPL on February 26, 2002.

B. Other Actions to Date

1. Previous actions

EPA initiated removal actions at the site in the Spring of 2000 at the Screening and the Export Plants. Later investigations identified several more contaminated properties. EPA initiated removal work on all of these properties, and has addressed over 210,000 yds^3 of amphibole asbestos contaminated soil, and over 35,000 yds^3 of contaminated debris. Sampling investigation work is ongoing, with the high probability of identifying more contaminated properties and potential exposure pathways that will require additional response actions.

The Original Removal Action and subsequent Amendment proposed various actions that have been initiated or completed, and a brief update on EPA's progress in competing those actions is provided below:

Location	Action Description and Status
Export Plant	Grace demolished and disposed of 4 buildings on this property, and removed approximately 16,000yds^3 of contaminated soil, and 1500 yds^3 of debris from the property. EPA and Grace are working to relocate the business from the remaining building, demolish the building, and complete clean up. Ongoing.
Screening Plant	Five parcels. Naturally occurring layers of asbestos material appear to underlie portions of the Site. Ongoing.
Raintree Nursery and Wise properties	All Raintree parcel structures were demolished. Some asbestos remains four or more feet below ground surface. EPA placed a fabric membrane at the four-foot excavation depth on the north side of the Site to aid soil stability and mark the limits of excavation. Complete.
KDC Bluffs Disposal Areas	EPA excavated and backfilled the three parcels. Sampling indicates low-level surface contamination of a 2-4 acre area which is zoned and planned for residential development. Risk factor evaluation is underway. EPA excavated 30-40% of the contaminated soil from the KDC-Flyway. Ongoing.

Rainy Creek Road	To improve haul road conditions and control elevated airborne asbestos fibers, EPA paved the lower half-mile of the road, built a decontamination station at the transition to the unpaved portion, and instituted active dust suppression. The USFS and Lincoln County have issued a joint temporary road closure, restricting access. EPA is working with the USFS to develop a site specific Memorandum of Understanding to coordinate each Agency's long-term responsibility for the Site. Complete.
Plummer Elementary School	EPA has excavated all contaminated soil, and restored the area for use as a playground. Complete.
Libby High School and Libby Middle School	EPA identified contamination under and around the tracks and bleachers, and in buildings. EPA removed all tailings and wastes, contamination underneath the bleachers and in the buildings. Most work has been completed. Track re-surfacing is planned (Spring 2002.) Ongoing.
Brownlee Property	EPA removed the pile of unexfoliated vermiculite, and all associated amphibole asbestos contamination. Complete.
Seifke Property	EPA cleaned or removed all equipment contaminated with amphibole asbestos, demolished two outbuildings, and cleaned the interior of the main residence. EPA also excavated all contaminated soil and debris, and moved this material to the mine for disposal. Some building reconstruction slated for Summer 2002. Ongoing.
Burris and Calhoun Properties	EPA found tremolite rocks used as garden landscaping borders at both sites. The garden soils contained amphibole asbestos at levels greater than 1%. EPA found significant levels of asbestos fibers in dust in the Calhoun residence. EPA removed all contaminated soils and source materials, and cleaned the interior of the Calhoun residence. Complete.
Johnson, Sanderson, Temple, Struck, Rice, Fuhlendorf, Spencer, and Westfall Properties	EPA found vermiculite wastes and asbestos up to 10% by PLM in yard or garden soils at all these locations. EPA removed any tremolite rocks, and either covered or demarcated major contaminated areas. EPA is characterizing nature and extent of contamination. Ongoing.
Champion Haul Road	EPA found vermiculite ore and/or tailings with asbestos concentrations greater than 1% at the surface, where the road leads from Highway 37 into a residential area. EPA covered these areas with a durable geotextile fabric, while sampling continues. Ongoing.

2. Current actions

EPA is continuing its on-site investigations in Libby. These include the traditional nature and extent type sampling (Phase I Sampling Plan, January 4, 2000), and some site specific exposure scenario sampling (Phase II Sampling Plan, March 2001).

Most of the previous removal work is either complete or shut down for the winter. EPA is developing details for the ongoing and new projects.

C. State, Local and Other Authorities' Roles

The State of Montana, ATSDR, PHS, USGS, USFS, Lincoln County Health Board, Libby School Board, and City of Libby officials have been directly involved in this Removal Action largely in the area of communication with the Libby community, a medical screening program, collection of background data, support, and routine sampling and monitoring.

ATSDR and PHS have cooperated with EPA in on-going exposure investigations in Libby. A second phase of medical screening was begun in August 2001. ATSDR and PHS are also working with local physicians, Lincoln County, and the State Medical Officer to develop an epidemiological case series for Libby asbestos victims. This will focus on identifying the nature, presentation, and progression of the disease endpoints from exposure to amphibole asbestos.

USGS is providing EPA with technical assistance in documenting the mineralogical and morphologic nature of the Libby amphibole asbestos. They are also conducting a remote sensing, infrared spectroscopy analysis of the Libby basin to help identify the presence of surface deposits (man-made/disturbed by human activity, or undisturbed/naturally occurring) of the amphibole asbestos. USGS has also been working with EPA to augment and develop the Agency's analytical techniques.

The USFS is providing assistance at the Site with the road closure for Rainy Creek, traffic control, and fire management. USFS is also working with EPA to establish a long-term plan for USFS-owned or controlled properties that have been impacted by Libby asbestos.

Lincoln County has actively helped to provide assistance on medical screening and evaluations, as well as patient care. The Lincoln County Health Officer continues to play a central role in the dissemination of medical information to all of the parties involved. Arrangements have been made for Lincoln County to take over the ambient air sampling in and around Libby, incorporating this into their already established Clean Air Act program.

Although they have participated in many of the community activities and some of the planning efforts, the State of Montana does not have the needed resources to conduct the site investigations or clean-ups independently. The State has therefore deferred the lead on all Site activities to the EPA. EPA continues to provide information to the State, and continues to seek

State Officials' input on the implementation of Removal Actions.

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

A. Threats to Public Health or Welfare

1) Exposure to Libby Asbestos: EPA has identified and characterized amphibole asbestos contamination at locations in and around the Libby Valley. A partial list of locations includes former processing plants, schools, yards, gardens and rail sidings. Each of these locations exhibits an actual or potential complete human exposure pathway. EPA also found evidence that asbestos has been tracked out of primary exposure locations, resulting in numerous secondary exposures and health effects.

The weight of evidence demonstrates that the Libby community has a widespread medical problem related to exposure to amphibole asbestos. The ATSDR mortality study in Libby found elevated mortality associated with mesothelioma (a rare type of cancer which is very highly linked with asbestos exposure). The rate of mesothelioma in the area is extremely high, with over 1 case reported per 1000 Libby area population versus an expected rate of no more than 1 case per 1 million in the general population. In Libby, asbestosis occurs approximately 40 to 60 times above the expected incidence. NIOSH evaluated U.S. asbestosis mortality rates by county and found results similar to those reported in the ATSDR mortality study; i.e., the death rate from asbestosis in the Libby area is among the highest in the nation. Studies indicate that as many as 41% of Libby vermiculite workers with a ten year work history have been diagnosed with asbestosis (E.S. Wood, 1977, or E. Lovick, 1969).

EPA believes that chronic exposure to high levels of asbestos has compromised the health of many Libby residents. The health effects of this exposure, such as pleural scarring, are associated with increased risks of asbestos-related cancer and pulmonary impairment, and may diminish the ability to tolerate the effects of further asbestos exposure. Regardless of the mechanism, several studies have demonstrated the relationship between the findings of asbestos-related pleural and interstitial abnormalities, and serious progression of chronic asbestos-related diseases (e.g., Erlich et al., 1992; Shepard, et al., 1997; Cookson, et al., 1986; Viallat, et al., 1983).

The adverse health effects associated with exposure to amphibole asbestos in Libby has been clearly documented by occupational studies of former vermiculite mine and processing workers by researchers from NIOSH and McGill University [Amandus et al. 1987a, 1987b, 1987c; McDonald et al. 1986a, 1986b] which found that these former workers had significantly increased rates of asbestos-related pulmonary abnormalities and disease (asbestosis and lung cancer). Libby physicians describe health conditions consistent with these studies. Thus, EPA has concluded that Libby residents are a sensitive population. Asbestos exposures which would

present acceptable risks to a healthy population may cause an increase in disease for this highly impacted community.

W.R. Grace & Co. instituted a wet-milling operation at the Site, which reduced airborne asbestos releases. Grace then closed the mine and processors, further cutting workplace and widespread ambient exposure pathways. EPA response work has identified and addressed even more exposures that once existed in Libby. However, additional exposure pathways still exist, and Libby residents continue to be diagnosed with asbestos-related conditions. The latency period (ten to thirty years) for manifesting asbestos-related health effects means that the benefits of reducing the cumulative exposures to this community may not become evident for some time.

The effects of these exposures may be aggravated by the prevailing tendency for meteorologic inversions, which trap particulate contaminants in the area, resulting in Libby's historic designation as a non-attainment area for particulates. Libby also has a high rate of smokers. The synergistic relationship between cigarette smoking and asbestos-related illness is well documented, and likely a significant factor in the high disease rates observed in Libby.

EPA and others have demonstrated the friability of the fibers by conducting workplace and recreational exposure sampling scenarios in Libby. Sample results for sweeping, transferring vermiculite between containers, and EPA clean up activities yielded airborne asbestos levels of over 1.0f/cc. Sampling for recreational exposures have shown exposure levels of 0.2 f/cc on a school track. These levels far exceed the Occupational Safety and Health Administration (OSHA) permissible standard of 0.1 f/cc.

2) Asbestos releases to the environment from contaminated vermiculite sources: EPA has observed that older residences and businesses are most likely to contain contaminated vermiculite insulation in Libby. The age and condition of these structures increase the likelihood of exposure to asbestos. Since Libby has the second lowest per capita income in Montana, many people tend to do repairs themselves, or postpone home repairs. The resulting poor home condition increases the potential to release contaminated vermiculite insulation into the living space. In some Libby homes, vermiculite insulation is literally falling out into the living space from gaps around light fixtures and electrical switches. EPA sampling has detected amphibole asbestos in dust in the interior of approximately 25% of the homes tested in Libby. EPA believes that at least some of this contamination is related to the vermiculite insulation in the homes.

Aside from direct exposures, residents could sweep contaminated material up and throw it in the trash, causing a release to the environment. A person conducting abatement or renovation would likely dispose of a large quantity of contaminated vermiculite insulation in a manner that would result in an environmental release and exposure to amphibole asbestos fibers. Just as asbestos fibers are tracked into homes, they are also likely to be tracked out of homes, into the environment.

3) Multiple exposure pathways: In addition to adverse effects from exposure to asbestos among

workers and residents in Libby, there has also been a clear pathology associated with secondary exposures. The medical screening conducted by ATSDR during the Summer of 2000 documents an elevated rate of occurrence of lung abnormalities among family members of vermiculite workers. Likewise, the ATSDR screening also found elevated rates of lung abnormalities among people with non-occupational contact with asbestos contamination.

Based on this information and the Libby Administrative Record, EPA has made the following general conclusions regarding asbestos exposure in Libby:

- Whenever materials associated with Libby vermiculite are found in bulk, they will most likely be contaminated with amphibole asbestos;
- The amphibole asbestos found in the Libby vermiculite is highly toxic;
- The amphibole asbestos associated with the Libby vermiculite readily produces respirable fibers when disturbed;
- When people may conduct routine activities in or around the amphibole asbestos there is a high probability for exposure to asbestos at levels that present an unacceptable risk to public health; and,
- As the number of exposure routes increase, so does the risk of developing lung abnormalities and further progressing to symptomatic asbestos-related disease.

EPA and ATSDR investigations show that many residents in the Libby Valley have been and are being exposed to amphibole asbestos fibers through multiple exposure pathways. The August 23, 2001 ATSDR Report indicates that more than 90% of the participants in the medical screening reported 2 or more exposure pathways, while 40% reported six or more pathways.

The ATSDR report also notes that there was an increase in the rate of occurrence of pleural abnormalities, directly linked to a reported increase in exposure pathways. For example, while only 5% of the screening participants who reported no known exposure pathway (other than living in Libby Valley) had observed pleural abnormalities, 24% of the participants who had 6 or more exposure pathways had pleural abnormalities.

4) Specific Exposure Pathways: EPA detected amphibole asbestos in 339 out of 1164 (29%) of the soil and soil-like media samples from Commercial/Residential Yards in the Libby Valley, with 3.4% of the samples at levels greater than 1%. EPA sampled 263 properties, and detected asbestos at 162 of them (62%). Asbestos concentrations exceeded 1% at 21 properties (7.9%).

EPA has found wastes piles of bulk vermiculite ore on residential properties. Ten out of 12 samples (83%) taken from these piles had levels from 1% to 10% amphibole asbestos. On two additional properties the Agency found that residents used tremolite rocks as a decorative border. In general, EPA has found that yard contamination appears to be associated with the presence of vermiculite ores or mining/processing wastes. The contamination is usually confined to discrete areas of the property where these materials were placed, such as a garden or driveway.

EPA has collected settled dust samples from the interiors of buildings at 111 properties, of which 28 (25.2%) had detectable levels of amphibole asbestos. Overall, 12.7% of the dust samples showed detectable levels of amphibole asbestos fibers. Asbestos contamination in settled dust may be attributed to multiple sources, including former vermiculite workers, proximity to processing plants, presence of vermiculite insulation, condition of the building, past renovation work, contamination of surrounding property, and secondary contact and track-in contamination.

During the Phase II Sampling Investigation, the EPA collected air samples from personnel breathing zones and stationary locations during routine household activities (no active cleaning events) and during active cleaning (i.e., vacuuming or dusting). The data indicates that higher levels of amphibole asbestos in settled dust are related to higher airborne concentrations during household activities.

B. Threats to the Environment

The primary threat identified is inhalation exposure of human populations to Libby amphibole, with only secondary concerns for exposure to domestic or feral animals. The Action Memorandum dated May 23, 2000, contains additional discussion about potential threats to the environment.

C. Statutory and Regulatory Authorities

The following is a discussion on the factors used to determine the need for a Removal Action found in the National Contingency Plan at 40 CFR 300.415(b) (2) that relate to the conditions now found in Libby, Montana. The evaluation demonstrates that the conditions at the Site may present an imminent and substantial threat to human health and the environment and meet the criteria for initiating a Removal Action under Section 300.415(b) of the NCP.

1. 300.415(b)(2)(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances: Amphibole asbestos contamination is found in vermiculite ores and mining/processing wastes throughout Libby, and in settled dust and vermiculite sources in homes and businesses. Site-specific data indicates that exposures to Libby amphibole through a number of sources and environmental media are presently occurring at levels exceeding those commonly accepted for protection of human health.

2. 300.415(b)(2)(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released: The climate of the area is characterized by harsh winters and hot summers, with frequent atmospheric inversions, trapping particulate matter and airborne fibers in the Libby Valley, thus aggravating exposures.

3. 300.415(b)(2)(vii) The availability of other appropriate federal or state mechanisms to respond to the release: No other Local, State, or Federal agency is in the position or has the

resources to independently implement an effective response action to address the on-going threats presented at the site. EPA is coordinating its actions with State and Local authorities.

4. 300.415(b)(2)(viii) Other situations or factors that may pose threats to public health or welfare of the United States or the environment: EPA and ATSDR have documented that occupational, secondary, and environmental exposures of the public to a hazardous substance have resulted in broad public health impacts in Libby, Montana. The full medical impact of this Site will likely never be known. Hundreds of asbestos-related deaths have been recorded in Libby over the last two decades. There are currently hundreds more who suffer from asbestos-related illnesses. The ATSDR medical screening indicates that approximately 1,000 people have asbestos-related scarring in their lungs, or the pleural lining of their lungs. People with this type of scarring are at a much higher risk for developing lung cancer, mesothelioma, and/or fibrosis (McMillan et al., 1982; Erlich et al., 1992; Sheperd et al., 1997; Cookson et al; 1986; Viallat et al, 1983). The significant medical impact of asbestos exposure in Libby dictates the need for an expedient and thorough response.

Libby vermiculite was given away informally at processing facilities and not inspected, packaged, labeled, warranted, regulated or sold as a commercial product would be. EPA believes that under these unique circumstances the vermiculite to be removed from residence and businesses does not constitute a product under CERCLA §104(a)(3).

D. Cumulative Contributing Factors at Libby

The volume, nature and concentration of amphibole asbestos in Libby are unique. The Libby mine operated for nearly 80 years. During this time it is estimated that the mine produced up to 80% of the world supply of vermiculite ore. There is no other known ore deposit of this size in the world. In addition, EPA sample data taken in 2001 confirm that amphibole asbestos volume and contamination levels in the Libby vermiculite ore body are significantly greater than those found in vermiculite ore deposits in South Carolina and Virginia.

The distribution and extent of contamination in Libby are also unique. Massive historical and ongoing asbestos releases have left contamination throughout the Libby area. The processing facilities were very close to the center of town, contaminating many commercial and residential properties. Isolating a single source for specific contamination and exposure scenarios is difficult, if at all possible.

EPA has identified and evaluated 240 vermiculite processors in the US, and found 22 processors with asbestos contamination at levels of concern. The largest of these processors handled approximately 530,000 tons of Libby vermiculite ore from the 1960s to 1990. In comparison, EPA estimates that the total volume of material which came from Libby at 6.5 million tons from the 1960s to 1990. Also, the Libby plants milled, screened and "concentrated" all of this ore, prior to shipping. Therefore, a portion of the asbestos from the mine's total output remained in Libby, via processes which were not used at the contaminated processor plants.

No other site is known to have the unprecedented rates of asbestos-related health impacts found in Libby. Residents exhibit evidence of a high asbestos body burden, and exposures to additional asbestos via multiple pathways. These factors make Libby residents more susceptible to adverse health effects from future exposures. The Libby population also has a very high percentage of smokers and a high average observed body-mass index. These additional factors amplify asbestos-related health impacts.

The socioeconomic status and isolation of Libby further contribute to health issues. Homes tend to be old, in poor repair, and require frequent maintenance or renovation. EPA has documented ongoing releases of contaminated insulation from ceilings and walls inside Libby homes. Residents are likely to attempt unskilled asbestos abatement, home repair, or renovations. This greatly increases the risk of release and exposure to asbestos.

Libby geography compounds exposures and respiratory health issues. The enclosed valley and frequent atmospheric inversions have caused the Agency to designate Libby as a non-attainment area for airborne particulates. Many residents heat their homes with wood fires, further compounding poor air quality in the Libby Valley.

The Libby Asbestos Site is the top priority hazardous waste clean-up site for the State of Montana. The governor has asked that EPA place Libby on the National Priorities List (NPL), using the State's one-time, top priority designation. EPA proposed the site to the NPL on February 26, 2002.

IV. ENDANGERMENT DETERMINATION

The actual or threatened releases of asbestos from this Site, if not addressed by implementing the response action selected in this Action Memorandum, and those begun earlier (See Action Memorandum dated May 23, 2000), may present an imminent and substantial endangerment to public health, welfare, or the environment.

V. EXEMPTION FROM STATUTORY LIMITS

The Action Memorandum dated May 23, 2000, provided the documentation required to meet the NCP section 300.415(b)(2) criteria for a removal and the CERCLA section 104(c) emergency exemption from the $2 million and one year limits on Removal Response Actions. Conditions at the Site continue to warrant this exemption. This Action Memorandum Amendment requests a ceiling increase under the already granted exemption beyond the $6 million response decision making authority delegated to the Region. This ceiling increase is necessary to complete the Removal Actions authorized by the two previous Action Memoranda (dated May 23, 2000, and August 13, 2001), and the additional Removal Actions as described in

this Amendment.

Emergency Exemption: Current conditions at the Libby Asbestos Site meet the criteria set forth in CERCLA §104(c)(1)(C) [40 CFR 300.415 (b)(5)(ii) of the NCP]; present an immediate threat to public health or welfare or the environment; continued response actions are immediately required to prevent, limit, or mitigate an emergency; and such assistance will not otherwise be provided on a timely basis. If Removal Actions are not initiated or continued, people will be exposed to unsafe levels of amphibole asbestos at all the locations discussed in this Action Memorandum .

Consistency Exemption: Since the commencement of removal actions at the Libby Asbestos Site, EPA has proposed the Site to the National Priorities List. Continued response actions are appropriate and consistent with the remedial actions to be taken. Conditions at the Site meet the CERCLA section 104(c) consistency exemption from the 12-month limitation.

Removal Action expenditures at the Libby Asbestos Site will be tracked cumulatively against a (single) total Site ceiling. Any subsequent locations within the Site where actions are deemed immediately necessary as of the result of the on-going investigations in Libby will be documented appropriately and added to the Administrative Record. These actions will likewise be covered by the already established emergency, and tracked in a cumulative fashion.

VI. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed action description

EPA will continue and/or initiate actions to mitigate the threat to the public health and welfare or the environment posed by the amphibole asbestos present at a number of locations where vermiculite ores and mining wastes have come to be located. Removal of amphibole asbestos associated with vermiculite ores and mining/processing wastes in outdoor settings will be done by either mechanical excavation or the use of a vacuum truck when possible. Appropriate site controls and decontamination facilities will be used as needed.

In addition, EPA will remove vermiculite sources and amphibole asbestos contaminated dust from targeted homes and businesses within the Libby Valley, tailoring the cleanup based on the condition of the buildings. Although there will be variation among individual homes and buildings, the basic approach to removal of vermiculite and amphibole asbestos contaminated dust for a property will be as follows:

- Establishment of asbestos controls including physical barriers, negative air, decontamination/entry/exit corridor.
- Bulk removal of asbestos contaminated insulation in targeted homes and businesses.

- Removal/disposal of carpets, drapes and upholstery (if contaminated).
- HEPA vacuuming the interior of the home.
- Restoration as needed.

EPA will evaluate the feasibility and cost effectiveness of constructing an asbestos disposal cell at the Lincoln County Landfill. This would allow year round operations and accommodate the scope of the individual property clean-ups.

EPA will conduct the work in discrete geographic areas, addressing contiguous properties concurrently, where possible. Work will begin in the downtown Libby area closest to the former Export Plant, working outward through the Site. EPA will give priority to properties with multiple exposure pathways, high amphibole asbestos concentrations, or a current condition or activity (e.g., remodeling) that may produce high airborne asbestos fiber levels.

Finally, EPA will conduct follow-up monitoring to ensure that removal and restoration of buildings in Libby effectively and permanently addresses potential exposure to sources of respirable amphibole asbestos fibers.

2. Contribution to remedial performance

The Site is currently proposed to the National Priorities List (NPL). The OSC and RPM are collaborating on all sampling investigations to ensure that any removal investigation work is consistent with that required by a remedial investigation. The RPM is involved with most Removal Planning (such as evaluating the use of the Lincoln County Landfill) to ensure that clean-up goals and long-term management needs are met. Given this close coordination the current removal actions will be consistent with any remedial cleanup that might be taken.

3. Description of alternative technologies

EPA has not found appropriate alternate remediation technologies given the nature of the amphibole asbestos contamination, the scope of the project, and its time-critical nature. EPA will consider alternate remediation technologies that might enhance response actions, if any are identified in the course of this, or any subsequent removal actions at the Site.

4. EE/CA

This is a Time-Critical Removal Action; thus, an EE/CA is not required.

5. Applicable or relevant and appropriate requirements

See the Federal and State ARARs identified and/or discussed in the attached Action Memorandum (May 23, 2000).

Poor Quality Source Document

The following document images have been scanned from the best available source copy.

To view the actual hard copy, contact the Superfund Records Center at (303) 312-6473.

6. Project Schedule

Pending approval of this Action Memorandum Amendment, work will begin in Spring 2002. Completing the excavations and restorations already underway will be the first priority. The construction of the infrastructure necessary to support the clean-up of the individual homes in the Libby Valley will be the second. The start of removal of vermiculite ores, mining wastes and other sources from the downtown area should begin in Summer 2002. Work is likely to take two to three construction seasons. A more detailed schedule will be developed upon Headquarters approval of this Action Memorandum Amendment.

7. Estimated Costs

The costs estimates presented in this section will be presented in two parts: 1) a proposed overall Site ceiling incorporating the current Site ceiling and costs to date by removal area, the proposed increases due to the additional number of properties where vermiculite ores and mining/processing wastes have been found, closeout of on-going projects and a planning figure for the construction of an asbestos landfill cell. 2) A breakdown of the estimated cost per property for vermiculite removal.

Table 1, Proposed Site Ceiling by Project Area

1. Export Plant (PRP - Lead)	$1,525,000	$ 100,000	$ 1,625,000
2. Screening Plant (Fund - Lead) -Removal Work - Settlement (Parker)	 $7,605,000 1,500,000	 $ 1,000,000 -0-	 $ 8,600,000 1,500,000
3. KDC Properties (Screening Plant)	$1,500,000	$ 1,500,000	$ 3,000,000
4. School Tracks and other Affected Areas	$2,500,000	$ 1,000,000	$ 3,500,000
5. Residential Areas	$ 600,000	$ 6,200,000	$ 6,800,000
6. Rainy Road	$1,500,000	-0-	$ 1,500,000
7. Landfill Cell Design and Construction	-0-	$ 3,000,000	$ 3,000,000
8. Interior Removals and Clean-up	-0-	$12,000,000	$12,000,000
9. Removal Sampling Support and Overhead	-0-	$ 4,000,000	$ 4,000,000

Subtotal Extramural	**$16,930,000**	**$28,800,000**	**$45,525,000**
Contingency	$ 3,386,000	$ 5,509,000	$ 9,100,000
Total Extramural Costs	**$20,316,000**	**$34,309,000**	**$54,625,000**
INTRAMURAL COSTS			
1. EPA Direct Costs	$ 210,000	$ 100,000	$ 310,000
2. EPA Indirect Costs	$ 400,000	$ 250,000	$ 650,000
Total Intramural Costs	**$ 610,000**	**$ 350,000**	**$ 960,000**
TOTAL			

Table 2, Targeted Home, Business Interior Costs

	Residences			
		Removal, HEPA/Wet Wipe Interior	$ 8,000	
		Restoration	$ 3,000	
		Subtotal	**$ 11,000**	
	800 @ $11,000			$8,800,000
	Businesses			
		Removal, HEPA/Wet Wipe Interior	$18,000	
		Restoration	$ 5,000	
		Subtotal	**$23,000**	
	100@ $23,000			$2,300,000
	Public Buildings			
		Interior Cleaning	$42,000	
		Restoration	$14,000	
		Subtotal	$56,000	

	15@ $56,000			$ 840,000
Total				**$11,940,000**

There are other EPA Region VIII expenditures at the Libby Asbestos Site that are tracked separately from the above mentioned Removal Ceiling. These are the costs associated with the Removal Site Investigation (a.k.a.- Phase I Investigation), costs incurred by the Region to support the ATSDR Medical Screening, the Performance Evaluation Study, the funds given to USGS for technical support, the Exposure Scenario Investigation (a.k.a.-Phase II Investigation), funds provided to develop a site specific Risk Assessment, and funds used to help update the Superfund Program's Generic Asbestos Risk Assessment. For clarification purposes only, below is an estimate of the project budget for each of these items:

Task	**Regional Project Budget (FY00/01)**	**Regional Project Budget (FY02)**
Phase I Sampling Investigation	$ 4,500,000	$2,000,000
Medical Screening Support	$ 500,000	-0-
PE Study	$ 700,000	$ 50,000
USGS	$ 1,000,000	$ 50,000
Phase II Sampling Investigation	$ 1,000,000	$ 100,000
Site Specific Risk Assessment	$ 300,000	$ 200,000
Generic Risk Assessment	$ 500,000	$ 20,000
TOTAL	**$ 8,500,000**	**$2,420,000**

VII. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Delayed action will result in continued public exposure to unsafe amounts of amphibole asbestos. This will increase the risk to public health, and continue to burden an already heavily impacted community.

VIII. OUTSTANDING POLICY ISSUES

The Removal Actions described as part of this Action Memorandum are consistent with EPA policy. These actions are based upon the unique circumstances in Libby, Montana. This includes not only the level of cumulative exposure and multiple pathways, but also the highly

unusual facts indicating that homes in Libby contain insulation that consists of the asbestos-containing vermiculite mined at Libby that was not inspected, packaged, labeled, warranted, regulated or sold as a commercial product.

IX. ENFORCEMENT

Attachment 5 is a confidential summary of the Enforcement Actions.

X. RECOMMENDATION

This decision document represents the selected Removal Action for the removal of asbestos sources from targeted homes, businesses, and public buildings in the Libby Valley, which is within the Libby Asbestos Site, located in Libby, Lincoln County, Montana. The proposed Removal Actions have been developed in accordance with CERCLA as amended, and consistent with the NCP. This decision is based on the Administrative Record for the Site.

Conditions at the Site meet the NCP [40 CFR § 300.415(b)] criteria for a Removal Action, and the NCP [40 CFR §300.415(b)(5)(ii)] criteria for an exemption from the statutory limits. I recommend your approval of the proposed Removal Action. The costs include a ceiling increase of $34,659,000, with a total project ceiling of $55,635,000.

Approve: _____ Date:_____

Marianne Lamont Horinko
Assistant Administrator
Office of Solid Waste and Emergency Response

Disapprove:_____ Date:_____

Marianne Lamont Horinko
Assistant Administrator
Office of Solid Waste and Emergency Response

Figures:

Figure 1	Regional Map
Figure 2	Site Map

Attachments:

Attachment 1	Action Memorandum, May 23, 2000
Attachment 2	Action Memorandum Amendment, August 17, 2001
Attachment 3	ATSDR Medical Testing of Individuals Potentially Exposed to Asbestoform Minerals Associated With Vermiculite in Libby, Montana (Health Screening Study), August 23, 2001
Attachment 4	ATSDR Health Consultation (Mortality Study), December 12, 2000
Attachment 5	Enforcement Memorandum

SUPPLEMENTAL DOCUMENTS

Support/reference documents which may be helpful to the reader and/or have been cited in the report may be found in the Administrative Record File at the Superfund Records Center for Region VIII EPA, 999 18th Street, Denver, Colorado 80202.